Rays of the World

Edited by Peter R. Last, William T. White, Marcelo R. de Carvalho, Bernard Séret, Matthias F. W. Stehmann, and Gavin J. P. Naylor

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FOREWORD

Vision for a worldwide synopsis of the rays of the world has a rather long and convoluted history. The idea originated with Leonard V.G. Compagno during the production of his encyclopedic review of the sharks, FAO Species Catalogue. Vol. 4, *Sharks of the World: An annotated and illustrated catalogue of shark species known to date* (1984). In preparation for the ray catalogue he prepared a detailed outline of all known species and extensive annotated lists of the nomenclature and an outline of the higher classification of the group. The compilation included referenced synopses of the distributions and life histories of all species. While he was compiling these data, the research contingent specialising on ray systematics and biology grew with an upsurge in fishery surveys across the globe. These researchers were aided in their efforts to identify specimens collected on surveys by the systematic studies of J.R. Norman, H.B. Bigelow and W.C. Schroeder, R. Ishiyama, P.A. Hulley and M.F.W. Stehmann. In 1993, at the 4th Indo–Pacific Fish Conference in Bangkok, Compagno and P.R. Last hatched a plan to seek funding to produce a FAO guide to the world's rays, involving a broader team of specialists in ray taxonomy. Discussions with FAO along these lines ensued during the preparation of an identification guide to fishes of the Western Central Pacific, published in 2001. Soon after (in 2002), a meeting was held in Paris between some of potential key contributors, Compagno, Last, J.D. McEachran, and B. Séret, and representatives of FAO, M. Lamboeuf and K.E. Carpenter (editor of several of the FAO Species Identification Guides). The meeting was very productive and all agreed that a multivolume work covering all species of rays known to date should be treated at least in as much detail as was being devoted to a revision of Compagno's FAO shark catalogue, the first volume of which (Vol. 2, *Bullhead, Mackerel and Carpet sharks [Heterodontiformes, Lamniformes and Orectolobiformes]*) was published in 2001. Before the study could be launched, however, funds to support revisionary work on rays would have to be solicited and Lamboeuf was to investigate sources of funding through FAO. Funding proved to be unavailable and the project lay dormant for several years until Last, Séret and G.J.P. Naylor resurrected it at the 2012 annual American Elasmobranch Society meeting in Vancouver (Canada), albeit on a smaller scale and including a number of new key collaborators (Stehmann, M.R. de Carvalho, D.A Ebert and W.T. White) and co-authors. Impetus for the ray book was provided by new molecular insights gained from the Chondrichthyan Tree of Life Project, images of all ray species being painted by L. Marshall as part of this project, and distributional maps prepared earlier for FAO by McEachran. In recent decades there have been dynamic advances in oceanic exploration, methodology of systematics and data processing. France, Japan and nations of the Southern Hemisphere, especially Australia and New Zealand, have broadly surveyed the benthic aquatic resources of the South-West Pacific and the Eastern Indian Ocean and have discovered and described numerous species of rays. Molecular analyses of the gene codes of organisms, including rays, have proven very informative in distinguishing species, grouping them into monophyletic assemblages and hypothesising evolutionary relationships. The host of new species and results of these analyses have in many cases radically altered our understanding of the diversity and phylogenetic relationships and history of the rays and their relationship to the sharks, the sister group of the rays. The revised project is less expansive in terms of taxonomy and systematics than that initially designed by Compagno, Last, McEachran and Séret, but is of a considerably broader biological scope and will reach a wider and more diverse audience. Hopefully, it will create further interest in rays that will ultimately lead to a greater appreciation and understanding of this iconic group, far less notorious than its sister group the sharks. Ultimately, with greater exposure we hope to be in a stronger position to conserve this important resource.

J.D. McEachran

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The science input and compilation of this book has been very much a team effort involving many of the world's ray taxonomists. Impetus for this project was provided mainly by the editorial group, which first assembled at the 28th American Elasmobranch Society meeting in Vancouver (2012). The editors are especially thankful for the participation of all contributing authors to the project, as well as D. Ebert who also participated in the initial planning meetings. We are especially indebted to L. Compagno who originally championed a project to produce a comprehensive batoid catalogue through the FAO. Similarly, valuable taxonomic works of the broader chondrichthyan research community past and present have indirectly contributed to the content of this book and we acknowledge their efforts. Major present-day contributors to ray taxonomy and nomenclature include the following ichthyologists: G. Allen, D. Gledhill, K. Graham, M. Gomon, I. Jacobsen (Australia); M. Castex, R. Menni (Argentina), M. Araújo, U. Gomes, R. Rosa, H. Santos, T. Loboda, J. Fontenelle, R. Moreira, J. da Silva (Brazil); C. Bustamante, J. Lamilla, G. Pequeño, C. Vargas-Caro (Chile); S. Hernández Muñoz (Costa Rica); P. Deynat, S. Iglésias (France); T. Alpermann, R. Fricke (Germany); K. Akhilesh, K. Bineesh (India); Fahmi, Dharmadi (Indonesia); P. Psomadakis (Italy); K. Furumitsu, H. Ishihara, K. Nakaya, K. Nishida, A. Yamaguchi (Japan); A. Marshall (Mozambique); M. Francis, A. Stewart (New Zealand); S. Bogorodsky, V. Dolganov, A. Orlov (Russia); P. Cowley, P. Hulley, J. Wallace (South Africa); C.-H. Jeong (South Korea); H.-C. Ho (Taiwan); C. Vidthayanon (Thailand); A. Henderson (Turks & Caicos Islands); J. Bizzarro, E. Rochel, V. Faria, G. Hoff, J. McCosker, T. Miyake, J. Orr, J. Randall, T. Roberts, W. Smith, I. Spies, D. Stevenson (USA); A. Moore (UK). We thank W. Eschmeyer (USA), R. Fricke (Germany), and R. van der Laan (Netherlands) for their assistance with nomenclatural queries.

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1

INTRODUCTION

P.R. Last, M.R. de Carvalho, G.J.P. Naylor, B. Séret, M.F.W. Stehmann & W.T. White

SCOPE OF THIS BOOK

This book is the first complete pictorial atlas of the world's ray fauna. It also provides general identifying features and distributional information about this iconic, but surprisingly poorly known, group of fishes. Our knowledge of many of the species is based on a small number of individuals, and few of them have been researched well enough to gain even a basic understanding of their biology and life history. A highly valuable collection of paintings of all living rays (as well as sharks) has been assembled as part of a multinational research initiative (Chondrichthyan Tree of Life Project) to gain a better understanding of the diversity and evolution of this fish group. Images sourced from around the planet have been used to illustrate all of the rays found in oceans and freshwaters of the world. In a strict sense, this book is an atlas rather than an identification guide. Its main aim is to document the world's ray fauna and promote wider public interest in the group. New insights gained from molecular analyses of more than three-quarters of all living ray species, combined with reinvigorated morphological investigations, have led to many changes in both ray classification and the underpinning species diversity. The recognition of whole new families and genera of rays, and many newly described species, have resulted from this research.

In compiling this book, contributing authors gained an expanded appreciation of how little is known about members of this group. The published literature is riddled with incomplete or inaccurate information created by frequent misidentification of species and a limited research effort. In recent years, several regional guides to sharks and rays have attempted to redress this deficiency. Some 30 years ago a comprehensive guide to the world's sharks was produced and upgraded global treatments have followed. However, a similar reference covering global ray diversity has been a long time in gestation. Unsurprisingly, research initiated for this book has raised more questions than answers. While the book constitutes a major milestone in the documentation of ray diversity, it should be viewed more as an overview rather than the definitive study of these fishes.

BIODIVERSITY OF RAYS

The iconic group of fishes known collectively as the 'rays' is familiar to most of us. Our association with rays, better known in scientific circles as 'batoid fishes', extends back to prehistoric times. But what really are the rays? The term 'flat sharks' has been applied affectionately to the group and this analogy is more appropriate than some might think! Rays are first cousins of sharks, having co-evolved from early Mesozoic or late Palaeozoic shark-like ancestors about 250 million years ago (mya). They also share many life history traits and a multitude of morphological and anatomical characters that define fishes as a whole, such as having a backbone, living in water, breathing with gills, mostly being cold blooded and skin often scaly, which distinguish them from the tetrapods (land-dwelling vertebrates).

Living fishes are comprised of two primary taxonomic groups. Rays, along with sharks and chimaeras (elephant fish, ghost sharks, rabbitfishes and spookfishes), collectively known as the 'cartilaginous fishes', form one of these two major groups of modern fishes, the class Chondrichthyes (having skeletons built of cartilage with superficial calcification rather than bone). Earliest members of the group possibly lived in the world's seas during the late Silurian/early Devonian period more than

Fig. 1.1. Aldrovandi's 1640 monstrosity – the 'ray-dragon' was created from a carefully mutilated and dried skate. (BS)

Fig. 1.2. Fossilised stingray (*Cyclobatis*) from the Upper Cretaceous. (MC)

400 mya, or possibly even earlier in late Ordovician times according to evidence from their scales. Today, some 1250 or more species occupy a variety of aquatic ecosystems in all oceans, from adjacent continental and insular coastlines to the deep abyss, as well as inland in rivers and lakes. The other major extant group, the class Osteichthyes (Actinopterygii) or bony fishes, is much larger and makes up about 95% of modern fishes, including an impressive array of body forms, from eels to flounders, groupers and tunas.

Rays are the largest subgroup of the chondrichthyan fishes and presently comprise 26 families and 633 valid named species. However, an additional 50 unrecognised or undescribed species are known to exist. In contrast, sharks consist of 34 families and ~516 valid species, and chimaeras 3 families and 51 species. Rays vary in dimension from ~25 cm or so to more than 6.5 m in total length or disc width. Rays differ from sharks and chimaeras in having gill slits located on the ventral (under) surface of the head. The body is mostly dorsoventrally flattened and usually modified into a disc formed by the complete (e.g. stingrays) or partial (e.g. guitarfishes) fusion of the pectoral fins with the head and trunk. Pectoral fins, which are often greatly enlarged, join the head forward of the gill slits. The disc may be circular, oval, triangular, heart-shaped or resembling a rhombus (rhombic). Five gill slits (six in one species) are located on the ventral surface of the body, with the eyes situated on the dorsal surface. All rays lack an anal fin, and the caudal and dorsal fin(s), which are variably developed across the group, are also sometimes absent. Scales are usually represented on the skin as fine denticles or, in many species, as heavy thorns and scutes; however, in some species, denticles are totally absent.

Most rays live in demersal habitats where the majority of species are either mainly benthic (living on the substrate) or benthopelagic (swimming close to bottom but not resting on the substrate). Their flattened body is perfectly adapted for life on the seafloor, either resting or lying concealed within the sediments. However, some members of the group have a powerful muscular disc with enlarged, angular pectoral fins for swimming actively in pelagic habitats well above the seafloor. These pelagic species are typically wide-ranging in the oceans, whereas demersal rays are usually more highly specialised, preferring specific habitat types and having narrower geographic ranges. Nevertheless, some demersal species are common at certain locations but remain poorly known because the habitats they occupy have been inadequately surveyed. Rarity of specimens in biological collections does not always equate to rarity in the wild. Nonetheless, our knowledge of most ray species is limited and characterising their habitat preferences remains a challenge.

Rays have successfully colonised a variety of niches over geological time, and the relative success of each group varies geographically. For example, marine ancestors of the Neotropical stingrays (Potamotrygonidae) colonised the freshwater habitats of tropical South America. Some skate genera occur only in particular ocean basins, often confined to shallow inshore habitats whereas others live on deep continental slopes down into the abyss. Ray faunas across the planet are the end products of long-term evolutionary processes influenced by plate tectonics, oceanographic factors and habitat availability. Their composition at regional scales differs significantly between geographic regions.

Our ability to define the structural elements and species compositions of regional faunas has been greatly assisted in recent years with the expanded use of DNA analysis. We are incrementally gaining a better understanding of regional linkages across ray groups and the associated biogeographical affinities of faunas. Underpinning these insights involves identifying and defining the basic currency of taxonomy and biodiversity – the species! The faunas of some regions are better known than others because both international research efforts and historically acquired knowledge of them vary greatly. For many ray groups and for some geographical regions, our knowledge is still in its infancy. The inadequacy of research specimens, images and baseline information for so many

Fig. 1.3. Numbfish (*Narcinops tasmaniensis*) resting on the seafloor. (PL)

species was one of the greatest impediments during the compilation of this book.

Our technical knowledge of ray groups varies similarly. Some iconic groups, such as sawfishes (Pristidae) and devilrays (Mobulidae), have been well studied in some regions, but few ray groups have been the subject of taxonomic revision to gain insights on a global basis. Some rays are rarely caught and, because of their often large size, are subsequently hard to transport, and store for long periods in collections. Hence, the type specimens of many species described more than a century ago have been lost or adversely affected by long-term preservation. Old imagery of types is often poor, and most early taxonomic descriptions of rays are very brief, describing features of a particular ray family rather than of a species. Hence, most of these taxonomic descriptions are of limited value in resolving nomenclatural issues.

The first comprehensive faunal coverage of rays was prepared by Müller and Henle in 1841 (*Systematische Beschreibung der Plagiostomen*), in which family-level groups were established and 55 new ray species were described. Even then, ray species outnumbered those of sharks (115 rays out of 212 species in total). Later, Garman (1913) built on their work, and the work of Duméril (1865), in his *Plagiostomia*, a compendium of 507 species of sharks and rays (now with 30 more species of rays than sharks). Since then, regional ray assemblages have been described in various identification guides, but the world's fauna had not been described in a single work for more than a century. The task of producing this guide was challenging in the absence of adequate material of many species in biological collections of the world. Authors needed to access all available data sources (existing literature, fresh and preserved material, photographs, etc.) to achieve this goal. Hence, the quality of species treatments provided in this book largely reflects the quality of information available for each species. The project identified glaring specimen and data gaps, and encountered other research impediments that need to be filled or overcome strategically in coming years.

ANATOMY AND SHAPE DIVERSITY

As a group, rays differ greatly in external features and more subtly in their internal anatomy and skeletal structure. Body shape in particular provides a strong indicator of their life history strategy and ecological role. The disc may be modified for life on the bottom or swimming in midwater. It can be rounded, strongly flattened, or soft and flexible enabling the ray to bury in silty substrates or move around freely inside caves and crevices. Pelagic rays are more active swimmers and usually have a firmer, more angular disc with heavier body musculature. Disc shape can also vary

Fig. 1.4. Pectoral fins of most rays are joined to the head and trunk to form a flattened disc. (BS)

with developmental stages and between sexes in a species. Young skates usually have a more rounded disc that often becomes more angular with age. Adult male skates tend to have a more curvaceous disc with a longer snout than females. Such growth-related variations often make it difficult to characterise species precisely and have led to frequent misidentifications. Moreover, the extent of this variability has not been described for many species.

The shape and length of the tail also varies greatly in rays. In some groups, such as the giant guitarfishes (Glaucostegidae), the trunk and tail resemble sharks, whereas in stingrays (Dasyatidae) the tail can be very slender and whip-like. The attenuated tails of some whiprays, which can be several metres long, are among the longest of all fishes. In other ray families, such as the legskates (Anacanthobatidae), devilrays (Mobulidae) and butterfly rays (Gymnuridae), the tail is very short and filamentous. In these groups, the typical absence of dorsal and caudal fins results in the functional redundancy of the tail as a means of locomotion. Conversely, a strong muscular tail with large caudal and dorsal fins of some rays (e.g. shark rays) provide rapid propulsion and manoeuvrability. Tails vary from being extremely depressed to rounded in cross-sectional shape. Several groups have distinct skin folds on the mid-upper, mid-lower or lateral edges of the tail. The base length, height, shape and position of these soft structures are important in defining families, genera and species.

Fig. 1.5 Oronasal region showing the well-defined nasal curtain of the newly described maskray, *Neotrygon australiae*. (Carlie Devine)

The ray's body is supported by a skeleton consisting mainly of cartilage that is covered (rather than substituted) by a thin layer of honeycomb-shaped or prism-like calcification, typical of chondrichthyan fishes in general. This calcification is usually most apparent where the skeleton needs to be strongest, such as where it endures more pressure or force (jaws, cranium, shoulder girdle, etc.). The cranium (skull) is a single structure without sutures that protects the anterior central nervous system and some sensory organs of the head; its shape varies significantly among ray groups. Some groups such as guitarfishes have an elongated, internal cartilaginous support for the snout (rostrum); the sawfishes take the jackpot with their long saw-like snout. The rostrum of other rays is almost completely reduced or absent (e.g. stingrays). In the cranium, nasal capsules surround the nasal organs and nostrils, orbits accommodate the eyes, and the otic capsules house the inner ears (labyrinth organs responsible for hearing and balance). The upper jaws of rays (palatoquadrates) do not articulate with the cranium, a feature exclusive to the group. The vertebral column is attached to the cranium and extends posteriorly all the way into the caudal fin when one is present; stingrays lack a caudal fin and have a long cartilaginous tube in place of vertebrae in a mostly filamentous or whip-like tail. Anterior vertebrae are fused into the tube-like synarcual cartilage, another unique feature of rays that provides support for the disc and shoulder girdle; stingrays have a second synarcual associated with vertebrae in the pelvic-fin region.

The pectoral and pelvic fins of rays are internally supported by slender, elongate cartilages (radials) associated with broader basal elements that articulate with the shoulder girdle (scapulocoracoid) and pelvic girdle (puboischiadic bar) respectively. The fin webs are also supported by ceratotrichia, slender fibre-like structures made of an elastic protein, unfortunately now more widely known as the core ingredient of shark-fin (or ray-fin) soup. In rays, the longitudinal elongation of the basal elements of the pectoral fin (directed toward the snout and tail) and radials (radiating outwardly from these basal elements) provide most of the internal support of the disc. The disc is also internally connected to the cranium by the antorbital cartilage, whose complete calcification is another unique feature of rays. The pelvic fins contain the claspers (male intromittent organs developed from pelvic-fin radials), which are instrumental in passing semen from male to female. Clasper skeletons may be simple (e.g. electric rays, stingrays) or very complex with many distinct overlapping elements (e.g. skates). Variation in regions of the skeleton of

Fig. 1.6. Large pelagic aggregation of cownose rays, *Rhinoptera bonasus.* (Sandra Critelli)

rays continues to be a major source of information concerning their systematics and evolutionary relationships.

The head has undergone radical modification in rays. Its anterior profile can vary from short and broadly rounded, to long and pointed. A long angular snout is used by deepwater skates to bury and dig into soft sediments in search of prey. Skates living on soft muddy bottoms are less prone to damaging the delicate (often transparent) skin on their head and belly. Conversely, those living on rough, rocky bottoms often have thicker skin with a protective covering of granular denticles on their ventral surface.

Enlarged pectoral fins and a flattened disc enable rays to adopt several different methods of locomotion. They may use both the body and tail to 'swim' through the water like sharks, use only their pectoral fins, or use a combination of both methods. Those using the pectoral fin for propulsion either flap their fins to 'fly' (mantas), or undulate their fins (stingarees) producing a series of longitudinal waves. Frequency of fin movement largely depends on their size, and movements are usually more rapid when fins are shorter, and slower when the pectoral fins are disproportionately large. Some rays supplement tail swimming with short bursts of pectoral-fin undulation or flapping to accelerate and manoeuvre. Flexible rays (e.g. stingrays) are capable of spinning on a spot and their ability to change direction quickly comes from selective use of each pectoral fin. Tail swimmers often use the dorsal and caudal fins as rudders to make subtle shifts in direction.

In no other part of a ray, perhaps, has there been more radical modification than around the mouth and nostril (oronasal region), located on the ventral surface of almost all species. Groups have evolved many different feeding strategies for detecting and ingesting prey. Feeding requirements have led to the derivation of specialised methods of channelling water through the nostrils. Most notable of these structures is the flap-like nasal curtain possessed by some rays, and formed by the unification of enlarged anterior nasal flaps. Stingrays and several other ray groups have a fully formed (complete) nasal curtain, whereas in some other groups (such as the skates) the anterior flaps are greatly enlarged but are not fully connected posteriorly (nasal curtain incomplete). Members of some ray groups have a relatively wide and short nasal curtain with a weak sensory function (e.g. guitarfishes), whereas other rays have a soft, highly pored and elongated nasal curtain that is probably instrumental in sensing prey hidden in unconsolidated sediments (e.g. narcinids, narkids).

The mouth and its associated structures (i.e. jaws, teeth and the various surrounding sensory structures) differ considerably between ray groups (see Glossary). Sensory pores embedded in fleshy folds surrounding the mouth are used to detect prey in stingrays, and in many groups of rays having numerous sensory pores in the oronasal region. Deep furrows around the mouth enable the jaws to be projected forward to ingest prey. Feeding mechanisms and oronasal morphology vary greatly even within orders; for example some electric rays (the smaller benthic narkids and narcinids) are capable of suction-feeding by protruding their mouths forward as slender tubes, whereas others can ingest prey whole due to their flexible jaw cartilages and enormous gapes (e.g. torpedinids). Thick cartilages in the jaws enable some species to crunch through hard-bodied prey, whereas rays feeding on delicate prey often have finer jaw cartilages. Inside the mouth, the roof (top) and floor (bottom) are variably lined with pleats and fleshy ridges that have mainly a sensory function. Oral papillae, which lie on the floor of the mouth, vary in shape and number and can be used to distinguish some species.

Similarly, dentition (tooth shape and arrangement) varies widely across ray groups. The generalised food habits of a group can usually be assessed from an appraisal of its oral morphology. Eagle rays (Myliobatidae) and their allies have strong plate-like teeth capable of crushing large shellfishes. Other ray groups have multiple rows and series of flattened teeth arranged in pavement fashion (quincunx) that are used for crushing softer-bodied shellfishes. Some electric rays have many rows of sharp, slender teeth for grasping softer prey items such as fishes. In some groups, such as the skates, the shapes of the teeth usually vary between sexes (adult males usually have longer-cusped

teeth than females). In plankton-feeding mantas and devilrays, the teeth are reduced and non-functional.

Are rays smart? Rays have a high ratio of brain weight to body weight (even more so than sharks), and are probably among the most intelligent non-mammalian animals. Mobulids and stingrays in general are reputed for the elevated proportional size and complexity of their brain; mobulids (devilrays), for example, are known to exhibit complex behavioural patterns associated with mating and living in a three-dimensional habitat, which are correlated to the development of their brain. The brain typically has enlarged telencephalic regions and very convoluted and well-developed cerebella, indicative of highly integrated neuronal activity related to both sensory and motor functions. Electric rays have developed a specific region of the brain (*lobus electricus*) associated with the cerebellum that integrates stimuli associated with the use of their electricity producing (electrogenic) organs.

Like sharks, the thickness of the skin and squamation (development of dermal denticles and associated thorny structures) varies greatly across and within ray groups. The skin of some species is entirely naked (lacking denticles and thorns). Others lack dermal denticles but possess thorns or thornlets on some parts of the body, whereas in others, where the skin is densely covered with both sharp denticles and thorn-like structures, the body can be very rough indeed. Very large thorny structures (bucklers) are found on some large stingrays and skates. The form, density and distribution of denticles and thorns also vary greatly. For example, the bases of thorns can be star-shaped or rounded, and their tips blunt or sharp and/or upright or strongly curved. In skates, thorns are distributed variously around the orbits, on the snout and shoulder, and along the mid-line and margins of the disc and tail. Adult males also have a dense patch of often-retractable 'alar thorns' on each pectoral fin, and sometimes a patch of 'malar thorns' beside each eye.

Fig. 1.7. Scute-like thorns and smaller dermal denticles on the mid-disc of the skate, *Amblyraja hyperborea*. (Jayne Last)

In most stingrays and their allies, denticles have been modified to form a large venomous structure on the dorsal surface of the tail, the caudal sting(s). The sting is a stiff, flattened and tapering spine armed with basally directed serrations along its lateral edges. Two ventral grooves contain glands producing venom. The sting is covered with a sheath of skin which, when torn, allows venom to pass along the grooves into the victim. The serrations anchor the sting and its removal tears the victim's flesh, facilitating the absorption of toxic venom, a large water-soluble protein destroyed by heat.

As well as vision, audition, taste and touch, sharks and rays have highly developed sensory systems: the acoustico-lateralis and electroreception systems (ampullae of Lorenzini). The positions of sensory structures vary greatly at all taxonomic levels and their development is linked to evolutionary history. The acoustico-lateralis system is a network of sensory canals running on the ventral surface of the rays that allows them to detect pressure changes and displacement. The ampullae, which are scattered on the head and mostly on the ventral surface, allow the rays to detect weak electric fields emitted by living prey.

Electrogenic organs are present in two groups of rays, electric rays and skates. These groups produce different discharges for very different purposes. Electric rays have massive, kidney-shaped and externally visible electric organs occupying most of the disc on either side. These electric organs are formed by numerous (up to 450 in *Tetronarce*) columns of adjacent, hexagonal-shaped electrocytes derived from skeletal muscle tissue, which form a pulse-like current that moves vertically through the organ from bottom to top; discharging these electric organs exhausts the ray. These currents may be quite strong (possibly from 20 to 200 volts and a current of up to 35 amps). The discharges are weaker and mostly used defensively in bottom-dwelling species (e.g. narcinids), but very strong and employed as a paralysing weapon in large pelagic torpedoes (*Tetronarce*) that wrap their prey using their discs before ingesting them whole. In contrast, the electrogenic organs of skates are located in their tail, but the electrocytes are laterally arranged (lengthwise in the tail), cup- or disc-shaped, and derived from axial muscle cells. In contrast to electric rays, the skate's discharge is very weak (some ~60 mV, much less than 0.1 V) and is used for communication. Experiments have shown that skates discharge when in groups and less so individually. Electrocyte and electric organ shape, as well as the characteristics of the discharge (e.g. pulse duration), vary among skate species, and sometimes even between males and females of the same species.

BIOLOGY OF RAYS

Rays are slow-growing fishes with a diverse variety of life history strategies. Like sharks, they are typically long-lived compared to most bony fishes and their reproduc-

Fig. 1.8. The neotropical stingray, *Potamotrygon motoro*, lives solely in freshwater. (Michael Goulding)

tive methods are comparatively complex given the relatively low number of species compared with other non-chondrichthyan vertebrate groups. Fertilisation is internal in all ray groups. The elongate fleshy claspers of males channel semen into the female's cloaca during mating. The internal structures and cartilages that comprise the clasper vary across and within groups, and are sometimes important in discriminating different genera and species, particularly in skates.

Female reproduction is equally complex and several very different strategies have been adopted. Skates are egg layers (oviparous), whereas all other rays are live bearers (viviparous). Skates produce relatively hard but thin-walled, rectangular egg cases, made mostly of collagen fibres and mostly with filamentous horns at each corner. Egg cases are deposited by adult female skates on the seafloor or attached to a supporting structure so their embryos continue to develop independently of their mother. Young hatch after a few months to more than 2 years, largely depending on the temperature of their environment. Viviparous rays either nurture developing eggs internally without further nutritional input from the mother (yolk-sac viviparity, formerly known as ovoviviparity), or the developing embryo receives supplementary nutrition from protein and fat-enriched uterine milk secreted from the mother's uterus (histotrophy). This highly efficient reproductive mode used by stingrays (Dasyatidae) and their relatives, where milk is produced, enables the developing embryo to increase in size more rapidly than other modes. Unlike more advanced vertebrate groups, newborn ray pups do not need maternal care after birth or hatching.

Age of maturity has been examined for few rays but existing studies suggest it varies significantly, even between members of the same family. For example, males of some stingrays and stingarees (Urolophidae) mature at about 2 years of age. Skates often live longer, but known maturity ages vary widely, from 5 to 17 years. Females of viviparous species produce litters of 1–13 young with gestation periods ranging from a few months to a year or more. Oviparous rays (skates) typically have a higher annual fecundity than other rays, producing up to 150 egg cases annually, but deepwater and coldwater skates may reproduce only once every 2 years.

Rays, like sharks, are positioned at the middle to apex levels of aquatic food chains. All are carnivores or scavengers, feeding on a variety of benthic or pelagic invertebrates and small fishes, and even on other chondrichthyan fishes. Dietary behaviour is closely linked to the ecomorphological features of the ray group in question. Eagle rays, with their strong dentition, are capable of crushing hard-bodied invertebrates, such as shellfishes and crabs. Large benthic rays, such as some stingrays and skates, feed largely on fishes. Invertebrates, including a variety of crustaceans

and polychaete worms, are the main prey of small to medium-sized rays. Pelagic species, such as the devilrays, use gill-filter plates to feed largely on plankton. Rays play an important link in the food chain, as demonstrated in the Atlantic scallop fishery. Some have claimed that the overexploitation of coastal sharks caused ray populations to rapidly grow, resulting in the decline of the scallop population and the fishery to collapse. Similarly, the general decline of large pelagic shark populations is thought to cause an increase of the pelagic stingray populations.

The ability to move location or migrate varies greatly within ray groups. Egg-case laying rays, the skates, need to move to find suitable localised feeding or spawning habitat, whereas large live-bearing species carry their embryonic young and can disperse more freely. As a consequence, many truly benthic skates have very narrow ranges indeed, whereas more mobile live-bearing pelagic rays occur widely, often across several ocean basins. Migration in skates is often linked to seasonal peaks in spawning with minimal secondary reproductive activity throughout the rest of the year. This multipronged strategy assists survival of the species when reproductive conditions are not ideal. Aggregation of sexes after migration to certain locations provides the best opportunity for successful mating. Dispersal away from these locations after reproducing lessens competition between individuals for food. However, sexual segregation is not unique to rays. Sharks and many bony fishes use the same strategy. The intricacies of these migrations, such as mechanisms driving mass migration, as well as their patterns and frequency, are not well understood for most ray species.

Migrations of pelagic rays can be substantial in terms of distance, and the sizes of migrating aggregations can be enormous. Cownose rays (*Rhinoptera*) undertake a northern spring migration along the entire eastern seaboard of the USA, from Florida to Chesapeake Bay. Pups are born in the early summer in the north followed by mating later in the season. Aggregations then migrate southward into warmer water during autumn. Thousands of shoaling cownose rays, often containing only members of the same sex, have been observed at many locations across the globe.

Recent development of electronic tag technology should bring amazing insights on the geographical and vertical movements of the rays, exemplified in recent tagging studies of devilrays in the Atlantic. These epipelagic rays also utilise deep-sea habitats, undertaking regular dives down to 2000 m depth.

Traditional methods of identifying ray species have focused on the use of morphology and anatomy. More recently, other techniques have been used to supplement these practices. Advances in molecular methods have led to a revolution in our understanding of the taxonomy of ray groups and their classification. Some species, once considered to be widespread, are now known to consist of complexes of similar species. These methods have also provided insights into the evolutionary relationships of rays. Similarly, parasite studies have provided valuable insights into ray taxonomy and distribution. Parasites may be external (ectoparasitic) or internal (endoparasitic), and species are often confined to a single host species, or groups of related species. Like other vertebrates, rays often contain rich parasite faunas consisting of mixtures of worms (i.e. flukes, roundworms and tapeworms), marine leeches, and crustaceans (i.e. copepods and isopods). Major initiatives to characterise chondrichthyan parasite faunas have recently shed light on the rich diversity of these animals and their hosts.

Rays are mostly marine, but members of some stingray groups can live occasionally (Dasyatidae) or permanently (Potamotrygonidae) in freshwater habitats. These species are able to osmoregulate, i.e. adjust their blood concentration of sodium and nitrogen compounds (urea) to be in balance with the osmotic pressure of their environment. Ionic regulation is made by the rectal gland, which lowers these concentrations, and the kidneys control water influx to produce an abundant excretion of dilute urine. Whereas some marine dasyatids penetrate into freshwater, most potamotrygonids are effectively trapped in freshwater because they have lost the ability to concentrate urea at levels enabling them to survive in the sea.

BIOGEOGRAPHY AND EVOLUTION

Ray faunas are distributed in often well-defined faunal regions that are shared with other marine organisms. The life history strategies of some ray groups makes them ideal candidates for investigating biogeographic patterns in the sea. Possibly the most informative of these groups are the skates. These four ray families, which are among the most diverse of all chondrichthyan fishes, are widely distributed across the oceans. However, most species have relatively restricted distributional ranges. The genera, which are largely confined to ocean basins or parts thereof, are the end-products of localised evolutionary processes. Elucidating current biogeographic patterns across the globe will provide insights into ray evolution, as well as those of other marine animals sharing similar evolutionary pathways.

Knowledge of the evolution of rays, and indeed chondrichthyan fishes as a whole, is far from complete. Their largely cartilaginous skeletons do not fossilise as well as bone, and most of their fossil record is comprised of isolated teeth. The earliest examples of rays appeared during the Early Jurassic (~180 mya) as isolated guitarfish-like teeth (†*Doliobatis* from Europe). Fossil ray skeletons appear slightly later in the Late Jurassic (~155 mya), and again as forms related to guitarfishes (the European †*Asterodermus*, †*Belemnobatis* and †*Spathobatis*). Other preserved ray skeletons come from more recent geological deposits, mostly of marine environments, from various localities worldwide. The most famous

of these are the Late Cretaceous chalks of Lebanon (~95–85 mya), where up to two dozen species of ancient guitarfishes, sclerorhynchid sawfishes and cyclobatid skates occurred, and the Eocene Monte Bolca deposits (~50 mya) of Italy, where over a dozen species of guitarfishes, thornback rays, stingrays and electric rays have been found. In both instances, sediments were deposited in relatively shallow, warm marine habitats. Even though the fossil record of rays is reasonably representative it is less extensive than that of sharks, and very early ray fossils that may shed light on their morphological transition from shark-like relatives are still lacking.

Phylogenetic hypotheses of chondrichthyan evolution are based on independent morphological and molecular analyses that are not in total agreement (see Chapter 2). From a molecular perspective, modern rays are thought to have arisen from a shark group, much older and distinct from living shark lineages. However, there has been much debate as to whether rays are indeed evolutionarily separate from all living sharks, i.e. galeomorphs and squalomorphs (molecular consensus), or share a closer evolutionary affinity with squalomorph sharks (general morphology-based theory). Squalomorph groups include cow and frilled sharks (Hexanchiformes), bramble sharks (Echinorhiniformes), dogfishes (Squaliformes), angelsharks (Squatiniformes), and sawsharks (Pristiophoriformes). In any scenario, the hypothesis that rays evolved from sharks is supported by all researchers.

Nevertheless, many of the extant ray groups (i.e. families and genera) have independent evolutionary histories that are intertwined in time and space. Conversely, some other groups have evolved independently in different parts of the globe and their histories are more closely associated with other unrelated marine organisms (especially bony fishes) with which they co-exist. External evolutionary forces such as climatic changes, plate tectonics, shifts in oceanographic circulation, and the origin of physical barriers affecting dispersal, have led to species confinement, radiation and extinction events that are largely responsible for the present-day ray fauna.

2

PHYLOGENY AND CLASSIFICATION OF RAYS

G.J.P. Naylor, L. Yang, S. Corrigan & M.R. de Carvalho

Rays (batoid fishes) evolved from shark-like ancestors nearly 200 mya by becoming highly dorsoventrally flattened and moving their gill slits ventrally relative to those of sharks. This transformation impacted the morphology of the head in rays, creating a larger spiracular cavity and perhaps further loosening the articulation between the jaws and cranium. Despite their flattened aspect, rays have managed to occupy most of the same niches as sharks. Just as sharks have pelagic, benthic, filter-feeding, egg-laying and live-bearing forms, so too do rays. The flattened body shape and predominantly benthic habits of rays may have predisposed this group to higher rates of speciation than sharks, which have proportionally more pelagic species, because benthic environments are typically more variable than pelagic environments. This variability requires greater specialisation of the organisms that inhabit them, and subsequently limits the ability of benthic organisms to move between environments or over large geographical areas that are environmentally heterogeneous. Over time this may limit gene exchange over geographical space, ultimately leading to the generation of new species.

Rays form an indisputable *monophyletic* or *natural* group (including an ancestor and all of its descendant species). A belief that rays are a natural group has been espoused for over 200 years – all major classifications of elasmobranch fishes have included them as a single, well-defined group. Rays have many unique features that clearly set them apart from sharks. These include skeletal components that internally support the disc such as the forward extension of pectoral cartilages, calcified antorbital elements, the synarcual cartilage, and a pectoral girdle that is strongly articulated to the vertebral column. Early classical works, as well as those today, recognise fewer ordinal groups of rays than sharks (but more species). Even though rays are highly modified sharks (*winged sharks* according to American zoologist William Gregory in 1935), the majority of ray groups are strikingly different from sharks and from each other. It is precisely these morphological 'gaps' that have been highlighted in early (and some modern) classifications.

Even though rays are distinct as a group, their phylogenetic placement within modern chondrichthyans has been, and still is, widely debated. Most early classifications, such as the highly influential 19th century taxonomic works of Johannes Müller, Jakob Henle and Auguste Duméril, and detailed early 20th century anatomical studies (such as those of Tate Regan, Samuel Garman and Nils Holmgren), treated rays as the sister group to modern sharks (i.e. rays form a group equal in rank to an 'all-shark' group). Several recent studies based on DNA sequence data support this assertion. However, in the 1990s, modern phylogenetic studies based on anatomical features suggested that the rays are part of a larger elasmobranch group comprising dogfishes and their relatives (squalomorph sharks), and that angelsharks and sawsharks are, in particular, closer to rays than to other squalomorph sharks (dogfishes, cowsharks, etc.). In other words, some modern shark groups are more closely related to rays than to other shark groups, a notion first advanced in detail by Oxford zoologist Edwin Goodrich in 1909. This position has since gained wide acceptance among comparative anatomists and palaeontologists. But the debate is ongoing as studies based on more robust molecular data continue to classify chondrichthyans into two main groups, one for sharks and one for rays, as have most systematic works from the 19th and early 20th centuries.

While several studies have sought to establish the placement of rays among chondrichthyans, fewer have investigated the interrelationships *within* rays. Leonard Compagno, in his influential 1973 morphological study of elasmobranchs, suggested that rays should be partitioned into four ordinal groups that have long been recognised:

sawfishes (Pristiformes), electric rays (Torpediniformes), stingrays (Myliobatiformes), and a group comprising both the guitarfishes and skates (his Rajiformes). Among these groups, he considered sawfishes to be most basal, followed by the electric rays, while the most derived groups comprised the myliobatiforms and rajiforms. But in 1977, Compagno changed his views to indicate that electric rays, and not sawfishes, are the most basal ray group, placing much weight on the shark-like ceratohyal-hyomandibula connection in narkid electric rays (lost for all other ray groups early in their evolution).

The seminal works of Compagno, although also drawing from earlier sources, set the stage for subsequent contributions by various authors, including the important comparative anatomical studies by Kiyonori Nishida (1990) and John McEachran *et al.* (1996). Nishida's was the first modern analysis to suggest that guitarfishes (Rhinobatoidei in most previous works) are not monophyletic, with some guitarfish genera being more closely related to a group comprising skates plus stingrays, while others were placed more basally as the sister group to all rays except sawfishes (which he considered the most basal ray group). McEachran *et al.* disagreed in some respects with Nishida, reinforcing the earlier view that the electric rays form the most basal branch of the rays, followed by the sawfishes, with the crown group (the group farthest from the base) consisting of an unresolved assemblage of stingrays plus skates and guitarfishes (guitarfishes were again deemed to be non-monophyletic). Both Nishida and McEachran *et al.* brought a significant amount of novel morphological observations to bear on ray phylogeny.

Even though subsequent anatomical studies built upon these works and have helped clarify more of the internal branching patterns within rays (e.g. *Rhina* and *Rhynchobatus*), fundamental disagreements persist among morphological hypotheses. A more recent morphological phylogenetic study (Aschliman *et al.* 2012a), for example, is actually far less resolved than previous works, with many uncertainties regarding guitarfishes and sawfishes. Another divergence, of historical interest, concerns a dispute as to whether the electric rays or the sawfishes constitute the most basal group of rays. Both views have early supporters, but most modern phylogenetic studies endorse the electric rays as the most basal group (interestingly, Goodrich made the case for stingrays, and Holmgren's basal group comprised the electric rays plus the stingrays!). Also, some characters that have not been incorporated into morphological phylogenies contradict the patterns of relationships uncovered by recent studies (there are even lateral-line characters that support guitarfish monophyly!). So the jury is still out concerning morphological phylogenies.

Early molecular phylogenetic studies were primarily focused on the relationships among sharks and only included token representation of rays. Phylogenetic inferences in these early molecular studies were based on partial fragments of mitochondrial and nuclear genes. In 2012, Naylor and collaborators investigated the interrelationships among rays based on a much denser molecular sampling regime; however, their conclusions were based on a single mitochondrial gene (NADH dehydrogenase subunit 2). In this chapter, we present the phylogenetic relationships among the major lineages of rays estimated in a recent study by Yang *et al.* (unpubl.). Their study used data derived from all 13 of the protein-coding genes in the mitochondrial genome but, unlike any previous molecular study, included many more species representing all recognised ray families. All but five of the 85 recognised genera (exceptions are *Heteronarce*, *Electrolux*, *Pseudoraja*, *Dactylobatus* and *Makararaja*) were represented by one or more species (Yang *et al.* unpubl.). A phylogeny estimated from these data in conjunction with morphological support has been used to produce a revised classification for the rays, which is followed in this book. Yang *et al.*'s recent study has also helped identify areas for future research to investigate conflicts between molecular analyses and traditional taxonomy.

MAJOR SUBDIVISIONS AND ORDINAL-LEVEL STRUCTURE OF RAYS

Four major monophyletic groups are identified in this book (fig. 2.1), comprising the ray orders Rajiformes (for skates only, unlike Compagno's concept in which Rajiformes included guitarfishes), Torpediniformes (electric rays), Rhinopristiformes (guitarfishes and sawfishes), and Myliobatiformes (stingrays and their relatives). However, two families have fallen outside of these major groups: Zanobatidae (panrays) and Platyrhinidae (thornback rays). Our placement here of the Zanobatidae as sister group to stingrays is in agreement with previous morphological hypotheses, from McEachran *et al.* (1996) up to Aschliman *et al.* (2012a). However, the placement of the Platyrhinidae as the sister group to Torpediniformes radically differs from previous morphological studies but is supported by the molecular data of Naylor *et al.* (2012); interestingly Garman (1913) briefly hinted at this possibility.

Relationships among ordinal-level subdivisions are largely resolved in Yang *et al.* (unpubl.), and with novel results. The group Myliobatiformes plus Zanobatidae is the sister group to the Rhinopristiformes (a novel result relative to morphological studies), Torpediniformes (plus Platyrhinidae) is the sister to the above large group (and also novel), and Rajiformes is the most basal ray group (also novel compared to morphological data). The placement of the thornback rays (Platyrhinidae) as the sister group to the electric rays (Torpediniformes) is very weakly supported by the mitochondrial data. Hence, this counter-intuitive molecular placement for the Platyrhinidae is unlikely to be valid (platyrhinids

are intriguing in that there is morphological evidence for their placement in different positions among rays; for example, patterns of their ventral lateral-line canals group them with skates). However, some of the groupings in Yang *et al.* (unpubl.) have relatively strong morphological support (e.g. characters of the clasper and shoulder girdle for the Rhinopristiformes).

COMPOSITION AND INTERRELATIONSHIPS OF RAY FAMILIES

The topology of the estimated tree of Yang *et al.* (unpubl.) suggests several strongly supported major groups. Relationships among families in their respective ordinal-level groups are briefly discussed below.

Rhinopristiformes (shovelnose rays and their allies)

Five family-level groups are recognised within the Rhinopristiformes following Yang *et al.* (unpubl.): Rhinobatidae, Pristidae, Glaucostegidae, Rhinidae, and Trygonorrhinidae. Of these five families, only the Rhinobatidae is not inferred to be monophyletic. Rhinobatidae constitutes a paraphyletic group that is made up of two strongly supported monophyletic subdivisions. One subdivision comprises old world forms from Europe, Africa and Asia, including the genera *Rhinobatos* and *Acroteriobatus*, while the other comprises new world 'amphi-American' members formerly classified as *Rhinobatos* (now referred to as *Pseudobatos*). The family Pristidae (sawfishes) was resolved as monophyletic with strong support (as in all previous morphological and most molecular studies). In the current tree, *Rhina* forms a strongly supported monophyletic group with *Rhynchobatus*, which we recognise as a family-level grouping, the Rhinidae (also present in some morphological works, as both genera have, for example, bilobed caudal fins). Members of the genus *Glaucostegus* all formed a strongly supported group in the tree, now recognised as the family Glaucostegidae. This family is the sister group to Rhinidae but this relationship is weakly supported. A grouping including Pristidae, Glaucostegidae and Rhinidae, is, however, strongly supported. Interestingly, these families do not cluster together to form a monophyletic group in previous morphological studies, even though there is morphological support for a group comprising sawfishes (Pristidae) and guitarfishes as a whole, as recognised in earlier classical works. Finally, the Trygonorrhinidae, comprising the genera *Trygonorrhina*, *Aptychotrema*, and *Zapteryx* (previously included in the family Rhinobatidae) is strongly supported. In the current analysis the family Trygonorrhinidae forms the basal group within Rhinopristiformes, rather than being traditionally included within the family Rhinobatidae.

Rajiformes (skates)

Yang *et al.* (unpubl.) recognised two highly diverse skate families (Rajidae and Arhynchobatidae) and two smaller families (Anacanthobatidae and Gurgesiellidae), which is followed here. All but the Gurgesiellidae are inferred to be strongly monophyletic with good support. The Gurgesiellidae, containing the genera *Cruriraja*, *Fenestraja* and *Gurgesiella*, emerge as a well-supported monophyletic group based on analysis of nuclear gene data (not shown), but constitute a paraphyletic group based on the analysis of whole mitochondrial genomes presented here. Morphological-based classifications recognise up to two major groupings within the Rajiformes that are mostly equivalent to our Rajidae and Arhynchobatidae. *Cruriraja*, *Fenestraja* and *Gurgesiella* have not been recognised as a monophyletic group nor placed in their own family in morphological hypotheses.

Torpediniformes (electric rays)

The inferences from Yang *et al.* (unpubl.) suggest a very different arrangement than those implied by morphologically based taxonomy. Only the traditional Torpedinidae, comprising the genera *Torpedo* and *Tetronarce*, and the monotypic Hypnidae (*Hypnos*), are supported by the current molecular data (and as sister groups, as in morphological studies). The Narkidae, traditionally considered to include *Electrolux*, *Heteronarce*, *Narke*, *Temera* and *Typhlonarke*, is split into two disjunct groups: a basal group in which *Typhlonarke* groups with *Benthobatis* and *Discopyge*, and a more derived group in which *Temera* is sister to *Narke* (note that neither *Electrolux* nor *Heteronarce* were sampled). The generic constituents of the Narcinidae (*Narcine*, *Narcinops*, *Discopyge*, *Diplobatis* and *Benthobatis*) fall into three different clades, a great departure from morphological studies. The most basal clade comprises *Discopyge* and *Benthobatis* (but also includes *Typhlonarke*). The second clade comprises *Narcinops*, a group recently resurrected based on persuasive molecular and morphological support that includes Australian representatives previously placed in *Narcine*. The third and most derived clade comprises *Diplobatis* and *Narcine*.

Based on the sampling and inferred tree of Yang *et al.* (unpubl.), the molecular data suggest six distinct monophyletic groups within Torpediniformes: (1) *Discopyge*, *Typhlonarke* and *Benthobatis*; (2) *Narcinops*; (3) *Hypnos*; (4) *Torpedo* and *Tetronarce*; (5) *Narke* and *Temera*; and (6) *Diplobatis* and *Narcine*. However, since taxon sampling for this group is sparse (poorer than for other ray groups), and samples of *Electrolux* and *Heteronarce* were not included, we have elected not to reorganise the current classification in this book. Instead, the traditional four families Torpedinidae, Narcinidae, Narkidae and Hypnidae are retained, noting that only two of them appear to be supported by the molecular data of Yang *et al.* (unpubl.): Torpedinidae and Hypnidae. However, there is significant morphological support for the monophyly of Narcinidae (with five genera) and Narkidae (with five genera). As more taxa are added to the analyses, and an even better understanding

of morphological diversity is gained, it is likely that molecular inferences for this group will become better resolved.

Myliobatiformes (stingrays and their allies)

Eleven families in the order Myliobatiformes are recognised: Hexatrygonidae, Gymnuridae, Plesiobatidae, Urolophidae, Aetobatidae, Rhinopteridae, Mobulidae, Myliobatidae, Urotrygonidae, Potamotrygonidae, and Dasyatidae. In Yang *et al.* (unpubl.), the sixgill stingrays (Hexatrygonidae) are the sister group to all other stingrays in our phylogeny, with strong support for this relationship. The same relationships have also been found in other recent morphological and molecular studies, although in some molecular works the Hexatrygonidae formed a clade with the families Gymnuridae, Plesiobatidae and Urolophidae. Four groups of pelagic/benthopelagic rays are recognised: Aetobatidae, Rhinopteridae, Mobulidae, and Myliobatidae. The phylogenetic relationships of these groups to the Gymnuridae, Plesiobatidae, and Urolophidae are largely unresolved. However, each of these four pelagic/benthopelagic ray groups is also inferred to be monophyletic based on preliminary analyses of a more comprehensive sampling of the nuclear genome (data not shown). The placement of butterfly rays (Gymnuridae), much closer to the base of all stingrays in Yang *et al.* (unpubl.), is at odds with previous morphological analyses, all of which have placed gymnurids higher-up as the sister group to pelagic rays (Aetobatidae, Rhinopteridae, Mobulidae, Myliobatidae), with relatively good support. However, other molecular studies also differ from morphological phylogenies in this respect. Further studies with more information from the nuclear genome, and more detailed anatomical examination, will be needed to resolve the relationships among these families.

Members of the families Urotrygonidae, Potamotrygonidae (also including *Styracura*), Dasyatidae and *Megatrygon* form a robustly supported group in our tree. This group was also recovered with high confidence in past molecular studies, but not in morphological studies. The sister group relationship between amphi-American *Styracura* (previously *Himantura*) and South American freshwater stingrays (Potamotrygonidae), has been suggested by prior morphological and molecular studies. Herein, *Styracura* is provisionally included in the family Potamotrygonidae, acknowledging that the former is distributed in marine environments whereas the latter is found in freshwater (possibly the only modern supraspecific elasmobranch group to have evolved in freshwater); *Styracura* might eventually require its own family-level group.

The relationship between Urotrygonidae and Potamotrygonidae, although uncovered by earlier molecular studies, is not supported by morphological works. A close relationship appears to exist between *Megatrygon* and the potamotrygonids (including *Styracura*). The phylogenetic placement of *Megatrygon microps* in this study and in previous molecular studies is strikingly at odds with its traditional taxonomic placement in the Dasyatidae. However, a full morphological examination of this species has not been undertaken, largely because of the paucity of whole specimens in biological collections due to its rarity and large size. Consequently, *Megatrygon* is provisionally retained in the Dasyatidae in this book, but future taxonomic investigations are likely to show that the species belongs to a separate family group.

The family Dasyatidae, a large and complex group, was resolved as monophyletic, except for the placement of *Megatrygon* and *Styracura* as discussed above. Consequently, molecular support for the group with these genera included is only moderate.

FUTURE RESEARCH

The goal of any classification scheme is to capture natural groupings. The most natural way to classify organismal diversity is to adopt a method that captures the historical patterns produced by evolutionary processes that give rise to the observed diversity. In other words, one that reflects the evolutionary relationships of the organisms of interest. Under such a scheme, the evolutionary hierarchy can be derived directly from the classification. As compelling as this might seem, estimating species relationships from phylogenetic analyses is not always as easy as might be imagined. Phylogenetic estimates often seem to be in a perpetual state of flux. Inferences based on morphology often conflict with those based on DNA, as is seen here, and inferences based on different genes are rarely concordant. Indeed, it should be underscored that inferences based on different genes (gene trees) are not *expected* to be concordant as they reflect the vagaries of evolutionary processes, which we know differ across genes. The challenge is to make sense of these expected differences in order to infer the true evolutionary relationships among species.

As a consequence of these complexities, classification schemes have historically favoured nomenclatural stability over changes that more accurately reflect evolutionary history, until multiple sources of evidence are in agreement that changes are warranted. However, most of the groupings inferred from whole mitochondrial genome analysis corroborate the existing taxonomic hierarchy, but with a few exceptions (e.g. placement of *Megatrygon* outside the family Dasyatidae). Changes to ray classification will need more complete taxon sampling of some of the most problematic groups (e.g. the electric rays), and independent corroboration from other sources of data, such as comparative anatomy and nuclear gene data. All taxonomic frameworks are subject to flux as new sources of information become available; the one presented herein is no different. Nevertheless,

Urotrygonidae (17)
Potamotrygonidae (30)
Dasyatidae 2 (1)
Dasyatidae 1 (90)
Rhinopteridae (8)
Mobulidae (10)
Aetobatidae (5)
Myliobatidae (17)
Urolophidae (28)
Plesiobatidae (1)
Gymnuridae (12)
Hexatrygonidae (1)
Zanobatidae (2)
Glaucostegidae (7)
Rhinidae (10)
Pristidae (5)
Rhinobatidae 2 (8)
Rhinobatidae 1 (26)
Trygonorrhinidae (8)
Narkidae 1 (11)
Narcinidae 1 (23)
Torpedinidae (26)
Hypnidae (1)
Narcinidae 2 (5)
Narcinidae 3 (4)
Narkidae 2 (1)
Narcinidae 4 (2)
Platyrhinidae (4)
Arhynchobatidae (108)
Gurgesiellidae 1 (3)
Gurgesiellidae 2 (16)
Anacanthobatidae (14)
Rajidae (180)

20.0

Fig. 2.1. Family-level relationships of rays as shown by the Maximum Likelihood tree (–lnL = 563877.201796) inferred from the mitochondrial genome dataset. Outgroups are not shown. Number of valid species in each family is listed in brackets. Bootstrap values are shown beside nodes. Values equal to 100 are indicated by "*". Values lower than 50 are indicated by "–". No value is shown for families with only a single specimen analysed. Families with more than one lineage in the tree are indicated in colour. Dasyatidae 2 includes three individuals of *Megatrygon microps*; Rhinobatidae 2 contains amphi-American species of *Rhinobatos*; Narcinidae 2 includes *Narcinops*; Narcinidae 3 contains *Benthobatis*; Narcinidae 4 is comprised of *Discopyge*; Narkidae 2 includes *Typhlonarke*; Gurgesiellidae 2 contains species of the genera *Cruriraja* and *Fenestraja*.

this scheme represents a significant advance over prior contributions because it is based on much more complete data than previous efforts. The presented platform will hopefully provide a solid foundation for a more refined and integrated classification based on both molecular and morphological data in the future.

3

HUMAN INTERACTIONS

W.T. White, P.R. Last & B. Séret

Interactions between humans and rays extend back to prehistoric times. Cave drawings and rock engravings of stingrays and sawfishes indicate that rays were possibly an important food resource for Indigenous Australians for thousands of years. In ancient Egypt, craftsmen and artisans valued stingray leather for its durability and beauty. It was used to make armour and decorative items and has been found in the tombs of pharaohs. Some statues of the Egyptian god Min, dating back to the 4th millennium BCE, are decorated with engravings of sawfish rostra. The enlarged pearl thorn found on the mid-disc of some stingrays was highly sought after by ancient Egyptians and was considered a symbol of wealth and good luck.

In ancient Greek civilisations, rays figured prominently in mythology and medicine. Aristotle described rays as dangerous and Hellenes observed that venom from the caudal sting remained active well after the fish's death. The legendary Greek King of Ithaca, Odysseus (Ulysses), died at the hand of his son Telegonus after being pierced through the chest by a spear tipped with the caudal sting of a ray – fulfilling a prophecy that his death would come from the sea. Ancient Greek dentists apparently used the venom from stingray spines as an anaesthetic. References to the numbing effect of an electric ray (*Torpedo*) encounter are common in ancient Greek and Roman literature. The Greek philosopher Plato once compared the appearance of Socrates and his ability to baffle opponents to these rays and their numbing effect created by the discharge of their electric organs.

In more recent times, rays have retained a special place in many societies. Ray images, usually sawfishes and stingrays, figure prominently in the contemporary art of indigenous Australians, as well as western society. In Māori mythology, Punga is a supernatural being that is the ancestor of sharks, lizards and rays, and all other 'deformed ugly beasts'. In Mayan culture, the associated physiological effects of stingray envenomation using intact spines was considered an important part of bloodletting rituals to sustain gods and provide a conduit between natural and supernatural worlds. Sawfish rostra have been used by some Asian shamans for ceremonies to repel demons and disease, and also stand as totems on top of hut roofs to protect their inhabitants. Sawfishes are important to the native people of the Bijagos archipelago off Bissau Guinea where they are symbols of fecundity; masks surmounted with sawfish rostra are worn by adolescents during their manhood ritual ceremonies. The skin of electric rays are sealed in amulets and attached to the prow of the pirogues of West African fishermen to protect them against the dangers of the sea. It has even been suggested that the Yanomami people in the Brazilian Amazon have bizarre sexual rites involving copulation with various animals of the forest, including giant freshwater stingrays! The venomous nature of the caudal sting led to the belief that ray flesh is also poisonous, hence eating them is considered taboo by some native tribes of the Indo–Pacific. The Aztecs revered sawfishes as a type of 'earth monster'.

RAY FISHERIES

Rays are important as food in many parts of the globe. Annual catches of chondrichthyan fishes were estimated recently to be around 800 000 tonnes but the relative proportions of sharks to rays landed is not well documented. According to FAO fishery data, the world production of rays was around 26 000 tonnes in 2013, i.e. about 30% of the total production of chondrichthyan fishes. However, these figures do not reflect the actual catches as they do not include discards or undeclared catches. Most ray catches are bycatches of trawl and net fisheries. Ray

Fig. 3.1. 16th century scientific sketch of an electric ray.

Fig. 3.2. Large wedgefishes (*Rhynchobatus*) at an Asian fish market. (WW)

catches in some regions (e.g. India and Indonesia) are especially high. Most of the catches are not reported by species, but by larger mixed categories that do not allow accurate stock management. In many instances shark-like rays (wedgefishes, guitarfishes, sawfishes) get grouped into 'sharks', so estimates of 'ray' landings can be seriously underestimated. Indonesia has the largest shark and ray fishery in the world, with landing estimates in the low 2000s to in excess of 100 000 tonnes annually. In the artisanal fishery sector of Indonesia, rays account for about half of the total chondrichthyan catches, with stingrays (Dasyatidae) comprising about 90% of the total catch of rays by number and almost 45% by weight. In Mexico, artisanal fishery catches of chondrichthyans comprise almost equal quantities of rays to sharks.

While rays are used selectively throughout their distribution for their flesh (e.g. skates in the North Atlantic, stingrays from Asian seas), few species have been traditionally targeted. Most are either discarded (dead or alive) or find their way to markets as part of the byproduct of other fisheries. However, in recent years there has been increasing localised effort to target rays for more specialised uses. The Oriental shark-fin trade has led to dramatic increases in shark fishing in many regions over the last century. The shark-like rays are particularly sought after for the shark-fin trade and can attain higher prices than equivalent-sized shark species. These are sold together with other shark fins and are often difficult to distinguish from shark species, particularly once dried. This had led to targeting of rays in some areas. In Indonesia, tangle net fisheries target large rays with the most valuable and principal target being the wedgefishes (*Rhynchobatus* spp.) for their fins.

In many locations, rays are becoming increasingly apparent in market places where they had not been previously observed. There is an obvious trend in heavily fished areas. When effort continues to increase, catches of target species often drop, resulting in increased retention and marketing of previously undesirable species. Skate wings (skates, stingrays or eagle rays) seem to be increasingly prevalent in the seafood market where they were once rarely encountered. As recently as the late 19th century, rays and skates were not used as food fishes in Britain. However, by the early 20th century a small fishery for skates arose. As a result, many species suffered declines in the latter half of the 20th century with some, such as the once common Grey Skate (*Dipturus batis*), being largely extirpated from large parts of their former range.

There are other specialised uses of rays for food. Steamed shark head is a specialty dish in some Asian restaurants. In this dish, the snouts of wedgefishes or guitarfishes are considered a delicacy and the recent promotion of this dish by a celebrity chef on a television show has further pushed demand for this delicacy in some places. Barbecued stingrays have also become increasingly popular in Singapore and Malaysia.

In the last couple of decades, there has been increasing demand for the branchial filter plates of mantas and devilrays for use in traditional Chinese medicines in Asia. This has led to increased retention of these fishes in some locations and selective targeting in some instances, particularly in Indonesia. The very low productivity of these species and their subsequent vulnerability to overexploitation is of great concern.

Many of the largest ray species are long lived, and late maturing with low fecundities. As such, their populations are usually very susceptible to overfishing. Stingrays and wedgefishes in parts of the Indo–Pacific are particularly at risk. Catches of these species are not often monitored and their life histories remain poorly known, so their ability to withstand current levels of fishing pressure is not well understood. The inability to adequately identify species has been a widespread and common problem for fisheries managers. Without accurate identifications, the value of existing catch data and specific information on species is questionable.

Some rays are popular game fishes. Large guitarfishes and stingrays are targeted in sport fisheries, but often released after capture following the 'catch and release' rules of the International Game Fish Association (IGFA).

USES OF RAYS OTHER THAN FOOD

Rays are utilised in many ways other than simply as a food resource. Exploitation of stingrays in South-East Asia has led to innovative use of their byproducts, to an extent where these secondary uses have become more valuable than the original commodity. Skins from stingrays have been used for leather (e.g. to make bags, wallets, purses, belts, bracelets, watch bands and shoes), tails used as horse whips, and the cartilages for medicinal (herbal, Chinese)

Fig. 3.3. Rays are major exhibits in oceanaria. (WW)

products and curios (e.g. necklaces, bracelets). The high-value leather (also called 'shagreen'), covered with strong denticles, is particularly resilient to wear and tear. The use of stingray leather goes back a number of centuries. In the 18th century, the King of France, Louis XV, collected a number of items made from stingray leather, including snuff boxes, wig cases and sheaths. Between 1899 and 1933, the famous British artisan, John Paul Cooper, produced around 1000 items made out of stingray leather, including decorative boxes, frames and vases.

The robust nature of stingray leather has been widely recognised through the ages. In Japan, the handles of the most valuable and decorative samurai swords are lined with stingray leather. The rough skin offers the necessary strength and grip needed during the heat of long periods of battle. Samurai warriors also used stingray leather for armour, due to its resistance to being punctured, burnt or torn, and it being waterproof.

The people of Oceania have great respect for sharks and rays and both groups are disproportionately represented in carvings of native timbers. Mantas, eagle rays and stingrays are the most commonly carved rays from many of the Pacific Islands. Bone carvings of rays are also common in some locations.

Rays figure prominently in marine aquaria across the planet. They are among the most popular aquarium fishes and thus have an important role in attracting and educating the public. Rays include some of the largest fishes (mantas, stingrays, wedgefishes and shark rays) held in captivity and some of the highest profile exhibits. Touch pools featuring rays are a very popular attractions in public aquaria. Aquaria also serve a role in education and science. Our knowledge of their food habits and reproductive biology, and interactions with other species, is partially based on rays kept this way.

Freshwater stingrays from Asia and South America in particular, are important in domestic and international aquarium trades. Keeping these animals alive can be problematic as they are sensitive to water quality, post-capture and handling stress, and the size of the tank they are kept in; also, being carnivorous they need lots of food. These rays usually make good aquaria subjects as they are generally placid and not aggressive toward large fishes also in the aquarium. However, aquarists must carefully select appro-

Fig. 3.4 Dive ecotourism – Manta interactions have become major regional attractions. (Ron Taylor)

priate species as companions. Large non-aggressive fishes, such as characins (tetras) and some South American cichlids, are popular as they are typically docile, too large to be eaten, and do not steal the ray's food. The aquarium trade sometimes provides negative conservation considerations. Illegal poaching of freshwater stingrays in South America is becoming an increasing problem.

The large size attained by some inshore rays has fuelled gladiatorial aspirations among some humans. In recent times, hooking and spearing rays for recreational pursuits has been considered by some to be a challenge. Killing rays unnecessarily is not condoned by most cultures, so the practice now seems to have been reduced in most places.

The high profile of rays in current human civilisation is reflected by their use as names in commercial brands and enterprises. The car manufacturer Chevrolet released its iconic sports car, the Corvette Stingray, more than 50 years ago and current models are still in production; similarly, the Music Man Classic Stingray 4 string bass guitar. A sawfish was used as the emblem for the infamous German submarine U-96 during WWII. Ray names have also been widely adopted as names of seafood outlets, restaurants and holiday resorts, and the stingray shape has been used as the architectural theme for one of the world's most exclusive hotels at Coles Bay, Tasmania.

HUMAN ENCOUNTERS

Impressions of rays as threats to humans, pests or animals of little use or regard, have been generally replaced by wider community respect and intrigue. Large rays are imposing underwater and usually become memorable moments for divers when encountered. They are curious animals and often approach divers out of interest or for food, and often move comfortably around a diver without concern, making them easy to observe and/or photograph.

Rays have become major regional attractions important for ecotourism and generating revenue. Dive tourists are prepared to travel to remote regions of the world to view special manta aggregations (e.g. Maldives, Yap, Ecuador, Hawaii, Australia). In the Maldives alone, there are an estimated 91 manta dive sites. The revenue generated from diving and snorkelling activities at these sites has been estimated to be worth around US$8.1 million annually. Still, there has been a realisation in recent years that there are negative impacts caused by large numbers of divers and snorkellers on manta numbers. As a result, there is a need to improve tourist education and develop stricter regional guidelines for these activities to be sustainable.

Observing stingrays has become a major tourist attraction for swimmers and snorkellers in some areas (e.g. the Caribbean and south-western Australia). Diving with rays can contribute to their conservation as long as they are observed naturally without feeding them. The internationally renowned Stingray City at Grand Cayman (Cayman Islands) is a series of shallow sandbars where divers and snorkellers can observe, interact and pet large congregations of Southern Stingrays (*Hypanus americanus*). Similar spots occur in the Bahamas, French Polynesia, and New Zealand. A ray's skin is highly tactile and when stroked some skates move into a state of tonic immobility, or become temporarily paralysed. Similar behaviour in sharks is thought to be a response to make females more accessible to males during mating.

Human encounters with rays can be either opportunistic or premeditated. Fishers and divers can have interactions with live rays that are unplanned. Unlike experiences with some of their shark cousins, the risks of injury from encounters with rays is considerably lower. Nonetheless, rays can inflict injury and have even killed humans, but examples of unprovoked attacks are rare.

Most serious injuries to humans come from stingray groups (Dasyatidae, Potamotrygonidae, Urotygonidae and Urolophidae). Injuries are normally inflicted when a ray is accidentally trodden on or disturbed by an unwary victim. Stabbing wounds from the caudal stings of even

Fig. 3.5. Observing rays underwater – gigantic whipray (*Urogymnus*) off Indonesia. (Mark Erdmann)

small rays can be very painful. While stings usually cause only minor localised tissue damage, the wound can take months to heal due to unusual infections. The caudal stings of large stingrays are usually very long and sharp and, when propelled by the ray's strong tail musculature, are capable of delivering powerful and repeated thrusts causing serious physical injury to the victim. Divers attempting to ride the disc of large stingrays have been seriously injured. In more serious cases, victims have succumbed to fatal stab wounds to the chest. Hammerhead sharks, which often feed on rays, are commonly observed with dislodged barbs embedded in the jaws and skin around the mouth. Surgery is sometimes needed to remove caudal sting fragments from wounds to humans. Stingrays also need to be handled with care when landed by fishers as the tail can thrash around rapidly when the animal is distressed. Although not ideal and not to be encouraged, fishers often remove caudal stings or sever the tail of captured rays to avoid being injured. Despite their imposing size and weaponry, large stingrays are not naturally aggressive. Small ray species are often timid but can cause minor problems for humans. Stingarees (Urolophidae) often lie concealed beneath sediments with only their eyes exposed. An unwitting diver or wader placing their hand or foot on the disc can be accidentally stung before the ray rapidly retreats.

Sawfishes have a spectacular saw-like snout sometimes exceeding 1 m long in adults that acts as both a sensory organ and hunting weapon capable of slicing through smaller fishes. Wielded by powerful trunk musculature, a blow from the saw can cause serious injury to a human in or out of the water if the fish is panicked. There are no confirmed cases of fatalities from a sawfish strike to humans. The inshore habitats where sawfishes once occurred more commonly are still frequented by large crocodiles. Sawfishes are now rare and constitute a much lesser threat to humans than their reptilian counterparts.

SCIENTIFIC RESEARCH ON RAYS

Compared to their bony fish cousins, sharks and rays underwent a long period of time with minimal research focused directly on them. Recent decades have seen a huge increase in the volume of shark research, highlighted by a larger number of publications on various species and their life histories. However, there has been very limited scientific effort focusing on rays. While this is beginning to change, there is still a paucity of data for the vast majority of ray species, even those that are commercially exploited and/or have undergone population declines. Recent taxonomic work on the Critically Endangered Grey Skate (*Dipturus batis*) found that it actually consists of two distinct, co-occurring species! Thus, there is a clear need for much more focused research on rays around the world, particularly on exploited species. This need is highlighted by a recent study that revealed that five out of the seven most threatened elasmobranch families are rays. Future research effort on rays should focus on those species of greatest conservation concern and the many species that are considered to be Data Deficient (see Chapter 4).

4

RAY CONSERVATION

P.M. Kyne

Rays are facing a global conservation crisis. High demand for sought-after products such as fins (from the shark-like rays) and gill plates (from the mantas and devilrays), along with their meat and other products, is driving overexploitation. Many species are undergoing population declines and in some cases localised (national or regional) extinctions of rays have been documented. While certain charismatic and iconic groups such as the sawfishes and the mantas are starting to receive management and conservation attention, and while the global status of their relatives, the sharks, is a subject that receives considerable attention, there are many lesser known ray species that require action to secure their status.

In general, rays share many life history traits with sharks; collectively, the elasmobranchs (sharks and rays) are characterised by late age at maturity, long lifespans, low fecundity and low natural mortality. This results in low reproductive output and a limited ability to recover from overexploitation and/or population depletion. That said, individual shark and ray species differ from each other, and fall along a productivity spectrum, with some small and fast-growing (mainly coastal) species being more productive than larger (and often deepwater or pelagic) species. Sustainable exploitation is possible for many species where there is strong and effective fisheries management. However, in the absence of appropriate management and fisheries regulations, many ray species face an uncertain future. Significantly, many ray species are so poorly known that serious population declines and even extinctions (in the extreme case) may be going unnoticed.

The status of most of the world's rays has been assessed using a standard international system to characterise the risk of extinction of species: the International Union for the Conservation of Nature's (IUCN) Red List of Threatened Species (hereafter referred to as the 'IUCN Red List'). The IUCN Red List is the world's most comprehensive inventory of the global status of plant and animal species. It uses a single standardised set of IUCN Red List Categories and Criteria to evaluate the extinction risk of thousands of species, subspecies and subpopulations worldwide. Each assessment is supported by detailed documentation, including information on ecology, life history, distribution, habitat, threats, population trends, and conservation measures.

Each species treatment in this book lists the global IUCN Red List status for that species. Full species Red List assessments can be found on the IUCN Red List website (http://www.iucnredlist.org/). Evaluating the IUCN Red List status of species is a dynamic process, with re-assessments required every 10 years. As taxonomic, distributional and life history knowledge improves, and as new information becomes available on catch trends, trade and threats, a species' status may be downgraded (for example as a result of a conservation success) or upgraded (for example as a result of population depletion). Many ray assessments have been updated and published in 2015/16 and, with the re-assessment process ongoing, readers are urged to consult the Red List website for up-to-date species statuses.

Following are the IUCN Red List Categories (Fig. 4.1), their abbreviations and brief explanations (definitions taken from the IUCN Red List Categories and Criteria):

- Extinct (EX): a taxon for which there is no reasonable doubt that the last individual has died;

Fig. 4.1. The IUCN Red List Categories. (IUCN)

CR 1.8%
EN 5.4%
VU 12.9%
NT 10.4%
LC 25.9%
DD 43.6%

Fig. 4.2. The status of the world's ray fauna according to their IUCN Red List category. CR, Critically Endangered (10 ray species); EN, Endangered (30 ray species); VU, Vulnerable (72 ray species); NT, Near Threatened (58 ray species); LC, Least Concern (144 ray species); DD, Data Deficient (243 ray species).

- Extinct in the Wild (EW): a taxon that is known only to survive in captivity or as a naturalised population well outside the past range;
- Critically Endangered (CR): a taxon that is considered to be facing an *extremely high* risk of extinction in the wild;
- Endangered (EN): a taxon that is considered to be facing a *very high* risk of extinction in the wild;
- Vulnerable (VU): a taxon that is considered to be facing a *high* risk of extinction in the wild;
- Near Threatened (NT): a taxon that does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for, or is likely to qualify for, a threatened Category in the near future;
- Least Concern (LC): a taxon that does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category;
- Data Deficient (DD): a taxon for which there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that a threatened classification is appropriate; and,
- Not Evaluated (NE): a taxon that has not yet been evaluated against the Red List criteria.

Classification of species into the threatened categories (Critically Endangered, Endangered, and Vulnerable) applies a set of five quantitative criteria based on biological factors related to extinction risk, including rate of population decline, population size, area of geographic distribution, and degree of population and distribution fragmentation.

A total of 557 rays has been assessed against the IUCN Red List Categories and Criteria. Those that have not yet been assessed (species referred to as Not Evaluated) are mostly newly described species or those species that have been recently resurrected (i.e. previously considered invalid) and these will all be assessed in the future.

The status of the world's ray fauna is shown in Figure 4.2. Threatened species account for ~20% of rays (112 species). This lower bound figure (the sum of species assessed as Critically Endangered, Endangered or Vulnerable) assumes that no Data Deficient species are threatened but this is unlikely. If Data Deficient species are threatened at the same proportion as data sufficient species (those species assessed in any category other than Data Deficient), a mid-point proportion of threatened rays could be ~36%. An upper bound figure, one that assumes that all Data Deficient species are threatened, is ~64%. However, this latter figure is unrealistic, and the true proportion threatened is more likely to be around the mid-point value. The mid-point proportion of threatened rays is higher than the proportion of threatened sharks, birds, mammals, reptiles and bony fishes, and amongst vertebrates is surpassed only by amphibians.

Ray families with a high proportion of threatened species include sawfishes (Pristidae), wedgefishes (Rhinidae), guitarfishes (Rhinobatidae), giant guitarfishes (Glaucostegidae), sleeper rays (Narkidae) and stingrays (Dasyatidae). In general, these families are shallow-water inshore and coastal species, reflecting overlap with fishing activities on the continental shelf. Some primarily deepwater families such as the softnose skates (Arhynchobatidae) are less at threat, mainly because their primary habitat lies at depths beyond current fishing activities. However, the global trend of fisheries progressively moving deeper and

Fig. 4.3. Largetooth Sawfish (*Pristis pristis*) entangled in a gillnet. (Jeff Whity)

deeper, and to more isolated parts of the oceans, may alter that situation, and catches need to be monitored where fishing grounds are expanding. Deepwater species are also characterised by a high level of data deficiency, for example, the legskates (Anacanthobatidae) and pygmy skates (Gurgesiellidae).

The freshwater rays represent a small proportion of ray diversity overall, and include obligate freshwater species (those found only in freshwater) and euryhaline species (those that move between fresh and salt water). Many of these species, including the sawfishes and numerous stingrays, are at an elevated risk of extinction, resulting from their occurrence in restricted habitats that are subject to modification (damming and other barriers to upstream movement) and intense fishing. The obligate freshwater stingrays of South America (Potamotrygonidae) are characterised by a very high level of data deficiency (89%). There is an extensive trade in some of these species for the aquaria market, and additional data are required to better understand their status.

The shark-like rays (sawfishes, wedgefishes and guitarfishes) are amongst the most threatened elasmobranch families. The sawfishes are in fact the most threatened group of marine fishes; all five species are either Critically Endangered or Endangered, while all but one wedgefish species and one giant guitarfish species are threatened. The fins of these species attain some of the highest values for the international shark-fin soup trade, providing little incentive for fishers to release individuals caught as bycatch (can be either retained for marketing or consumption, or discarded).

Wedgefishes are directly targeted in some parts of South-East Asia and Africa in generally unregulated and unmanaged fisheries, while many inshore fisheries overlap with the ranges of a variety of guitarfishes. The targeting of seasonal aggregations of pregnant female guitarfishes occurs in parts of Mexico, Central and South America. For example, the Brazilian Guitarfish (*Pseudobatos horkelii*), was once abundant but has declined by >80% as the result of intensive exploitation from a variety of fisheries. The species is now protected in Brazil, the core of its relatively restricted South-West Atlantic distribution, but genetic identification of guitarfish catches shows that it continues to be caught illegally.

Sawfish populations have collapsed worldwide with sawfishes now extinct in at least 20 countries while records from many other countries are now sporadic and irregular. Northern Australia is the last stronghold for the four Indo–West Pacific species, while the once wide-ranging Smalltooth Sawfish (*Pristis pectinata*) of the Atlantic Ocean is now largely restricted to isolated locations such as Florida and the Bahamas. Sawfishes still persist in other remote regions, such as New Guinea and the lower Amazon River basin; surveying and adequately protecting these populations is a priority.

The electric rays have little to no economic value, being caught as bycatch in fisheries targeting crustaceans or bony fishes. Population declines in the Caribbean Numbfish (*Narcine bancroftii*) are the result of intense shrimp trawl fisheries. Low-value bycatch species such as these are rarely managed, and for species with very limited geographic ranges, such as the Ornate Sleeper Ray (*Electolux addisoni*), known only from an area of 10 km^2 off South Africa, management at small spatial scales may be required.

Many stingray species face a high level of direct exploitation, mainly for their skin or low-value meat. There is a considerable number of threatened stingrays (and other rays) in South-East Asia where catches are very high but declining, with fishers having to travel much further from port to maintain catches. Net and trawl fisheries in Indonesia and elsewhere are very extensive and, as a result, many shallow-water ray species are heavily exploited. The general lack of management measures based on scientific research and stock assessment is hindering the sustainable utilisation of these resources. Furthermore, the extensive loss and degradation of habitats such as coastal mangroves and embayments are other key threats to these coastal and inshore species.

The mantas and devilrays (Mobulidae) are subject to an international trade in their gill plates, which are used for a recently emerged Chinese medicine market, as well as domestic markets for their meat. Declines in some regional populations of *Mobula* species are suspected to be considerable, while their restricted life history (amongst the least productive rays) limits their ability to recover from depletion. The responsible development of sustainable dive tourism can significantly enhance the economic value of mantas and other species, and offer an alternative to short-term economic gains from fishing.

Fig. 4.4. Bottlenose Wedgefishes (*Rhynchobatus australiae*) at a fish market in Malaysian Borneo. (PK)

Fig. 4.5. A variety of large stingrays (Dasyatidae) landed at a fish market in Java, Indonesia. (PL)

No rays have been assessed as Extinct or Extinct in the Wild. Extinction is difficult to document in the marine and aquatic realm, but the Critically Endangered Java Stingaree (*Urolophus javanicus*) is a candidate. This species has not been recorded since its discovery over 150 years ago. Its range is in an area of intense fishing activity (Java, Indonesia) and extensive surveys of local fish markets and landing sites have failed to document another specimen. There are some other stingarees as well as some skates that are currently considered Data Deficient, but are known only from the original type series. While further surveys in appropriate habitats are required to determine their status, it is possible that some of these species may already be extinct.

The very high proportion of Data Deficient rays (nearly half of all species; Fig. 4.2) severely hinders understanding the full status of the group, and therefore implementing effective conservation and management actions where necessary. This proportion is similar to that of sharks, highlighting that the issue is relevant across elasmobranch groups. Data deficiency is far higher within elasmobranchs than all other vertebrate groups. Some species have been assessed as Data Deficient as a result of taxonomic uncertainty, but for many species it is a paucity of data that prevents accurate assessment of extinction risk. To address critical knowledge gaps, there is an urgent need to (i) collect accurate species-specific fisheries data, including for discarded bycatch; (ii) ensure prompt and accurate reporting of catches to relevant national and international authorities; (iii) encourage and promote basic life history research into Data Deficient rays; and, (iv) undertake surveys in under-studied regions and of the most poorly known species in order to accurately assess status.

In general, there are very few management and conservation measures in place for rays, either at international or national levels. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to ensure that the survival of species is not threatened by international trade. All sawfishes are listed on CITES Appendix I, which effectively bans international trade in these species or their parts, while mantas are listed on CITES Appendix II and are thereby subject to controls on their international trade (trade is permitted only after the exporting country provides evidence that trade is non-detrimental to the species' survival). The Convention on the Conservation of Migratory Species of Wild Animals (CMS) aims to conserve migratory species. All sawfishes, mantas and devilrays are listed on CMS Appendices I and II, which dictate their strict protection by countries that are 'parties' to CMS.

Some rays are protected through domestic legislation in particular range states, although both the number of species and the number of countries that protect at least one species are very low. Most listings relate to sawfishes, which are legally protected to some degree in 16 out of 90 range states including in Australia, the USA, Malaysia, India and Indonesia, amongst others. In developing nations though, compliance and enforcement is a significant ongoing issue. For some exploited species, fishery management regulations aim to ensure sustainable use. These regulations may occur at the regional level, for example quotas set for skates in the North-West Atlantic (although these quotas are often set higher than scientists recommend). Fishery regulations may also be set at the national or sub-national level, e.g. quotas for catches of Big Skate (*Beringraja binoculata*) and Longnose Skate (*Beringraja rhina*) in British Columbia, Canada.

To secure the status of rays locally and globally, in addition to addressing the issue of data deficiency outlined above, fisheries should aim to (i) monitor all catch landings to species level; (ii) prohibit the landing of threatened species; (iii) manage all other species sustainably; and, (iv) manage bycatch to minimise mortality of non-target species, in particular threatened species. Essential to this process is accurate species identification, the strict enforcement of fishing and protection measures, a significant increase in scientific observer coverage to monitor catches, and increased research on gear modifications, fishing methods, and habitat identification aimed at mitigating bycatch and discard mortality of rays.

5

ABOUT THIS BOOK

P.R. Last, W.T. White & G.K. Yearsley

The primary aims of this book are to characterise, illustrate, and provide a tool to assist with the identification of living rays of the world. Very few of the more than 600 species treated here are well known scientifically, and in many cases our knowledge of their morphology and distinguishing features is based on only a few individuals. Members of some ray groups are very similar in appearance, making them difficult to distinguish other than from their DNA or specific details of their internal skeletons. Consequently, some genera are defined only by subtle aspects of their internal anatomy. User-friendly keys, a rapid and reliable means of identifying animal species, cannot be constructed for some high-level taxonomic groups and species. While treatments of ray species in this book are not fully comprehensive and do not solve all taxonomic issues, they do provide the first global compilation of this iconic group of fishes.

Some readers may be unaware of the fundamental taxonomic principles of biological classification. Plant and animal species are classified, based on similarities of external and internal structure, into groups consisting of superficially similar organisms. Species are grouped in a hierarchical way to reflect their evolutionary history, a family tree of sorts. Through this process organisms are classified into major taxonomic groups of similar species. Phyla lie near the apex of the classification and are subdivided into decreasing hierarchical levels: classes, orders, families, genera and species. Species, which are regarded as the basic level of the classification, are named according to an internationally accepted binomial system proposed by Swedish scientist Carl Linnaeus in the mid 18th century. Each named species has only one valid scientific name, whereas common names often vary from place to place, language to language, or from person to person. Scientific names consist of two italicised words e.g. *Pristis pristis* (Linnaeus, 1758): the first name refers to the genus and starts with a capital letter; the second, called an epithet, is the unique name applied to a species within a genus, and is not capitalised. Scientific names include the name of the author(s) who named it, and the year in which it was named. Parentheses around the author and date indicate that the species was originally placed in a different genus. Some species may have more than one scientific name (synonyms), but only one of these (usually the oldest) is valid.

The classification used in this book is based on a scheme outlined in Chapter 2, with some variations where uncertainty still exists. The family presentation order doesn't necessary follow the proposed evolutionary sequence of groups because this scheme has not been fully resolved. Still, the classification and presentation used here differs from all previous books on rays, and these changes reflect newly acquired knowledge of their taxonomy based on recently published morphological and molecular investi-

Fig. 5.1. Swedish botanist and zoologist, Carl Linnaeus, who formalised the modern system of naming organisms.

gations. Some families and genera have been subdivided into new groups, whereas others have been amalgamated. This research is ongoing and more changes to the classification will be needed following more detailed taxonomic research on some groups.

The descriptive part of the book largely consists of a sequence of 26 chapters covering each family-level group and its component species (e.g. the family Dasyatidae, or stingrays, includes all 89 valid named species that presently comprise the group). Each chapter contains an introductory section that characterises the family group, followed by single page treatments for each of the species in that family. The layout for each species treatment follows a dual column format, including a painting, distributional map and conservation status logo for each species. Species treatments contain common and scientific names, a basic description of each species, information on their coloration, size, habitat and biology, and a brief discussion of similar species. Names follow current scientific standards for the group, upgraded recently based on research generated by the Chondrichthyan Tree of Life project, and independently by other contributors to the book. Common names generally follow English names in present international or regional use, or in some cases are derivations of these names. Where two or more ray species were found to have the same common names, these needed to be rationalised. Generally, species with the most common or oldest use of the name retained the original name. In other cases, where species were relocated to new genus or family groups, their common names were changed appropriately.

To assist with the identification process, keys are provided to major taxonomic levels, the families and genera (where there is more than one within a family). Readers wishing to use the guide to identify an unidentified specimen should first determine its correct family (using the key in Chapter 7). Within each family chapter containing more than a single genus, there will be a key to genera. Use the key to determine the correct genus and then search through species of the genus to identify the specimen using the images and descriptive information provided. If the correct family (or genus) is already known, the reader can go directly to the appropriate section of the book. Alternatively, if a genus and/or family is known, geographical distributions of species recorded in the checklist at the back of the book can be used to eliminate some species and flag candidates occurring in the region where the specimen was caught or acquired. Unfortunately, defining features of some groups (i.e. genera of skates and stingrays) are based largely on internal characters and are almost impossible to identify based solely on external morphology. In such cases, it is best to revert back to a major branch in the key, using the alternative choice in a couplet, if the first attempt fails to direct the user to the correct genus.

The layout and sectional content of this book were modelled on a guide to Australian sharks and rays (Last & Stevens 2009). The fully indexed text also contains an introductory chapter, sections on the classification and conservation of rays, human interactions with rays, as well as an illustrated glossary of terms, key to the families of living rays, a list of relevant references, and a checklist of the world's rays.

SPECIES TREATMENTS

As discussed above, members of each ray family are treated separately within their own chapter. Species are arranged alphabetically according to their scientific name. Each treatment contains the current scientific and common names of each species, a colour painting, and subsections containing main identifying features including coloration, size, generalised distribution with an associated map, details of habitat and biology, indication of conservation status, and brief comments on similar species. Where no information exists, comments flagging knowledge gaps were usually omitted. Treatments of each species are restricted to a single book page and for this reason authors were forced to be economical with content.

Common and scientific names

Scientific names follow current hypotheses and some of these have changed very recently. Research for the book uncovered many taxonomic issues, many still unresolved. Reviewing these groups is an ongoing process. Multiple common names are sometimes in frequent use for a single ray species and these can exist in many languages and vary between countries. We largely followed English names adopted in various FAO identification guides, but have made changes where the use of family or genus-group names were considered more informative or reflect the current taxonomy. For example, the 'Apron Ray' became 'Apron Numbfish' to show its link to the electric ray family, the numbfishes (Narcinidae). Similarly, where the same names have been used in different countries for different species, changes were needed; e.g. an Australian species, the 'Longnose Skate' (*Dentiraja confusus*), has now become the 'Australian Longnose Skate' to avoid confusion with the Eastern Pacific 'Longnose Skate' (*Beringraja rhina*).

Illustrations

The paintings of each species are re-creations based on available photographs and other illustrations, a huge task undertaken by Chondrichthyan Tree of Life artist, Lindsay Marshall. Where possible, a single image displaying intact external morphology and fresh coloration of a species was selected as a model. However, in most cases, composite images were used as perfect images proved difficult to source for most species. In some cases, fresh images of species could not be found. For those rare species, images of museum specimens (mostly acquired by Jayne Last)

Fig. 5.2 The Chondrichthyan Tree of Life Project documents the diversity of living chondrichthyan fishes using anatomical, DNA and fossil data.

were used to produce outlines. The original colour was gleaned from published descriptions, ad hoc images and other literature accounts, as most preserved specimens had lost their live coloration. Paintings were vetted during their preparation by the editorial team, and later skilfully enhanced at the final production stage by Australian National Fish Collection image manager, Carlie Devine. Line illustrations were used in the keys, species sections and glossary to demonstrate identifying characters or special features of rays (prepared by Georgina Davis and Suzie Bullock).

Identification

The descriptive subsection commences with a sentence, usually containing key features about the species (i.e. main field and distinguishing characters, etc.), that should be used in conjunction with often more general features that follow. Information provided in this initial sentence is often qualified in the text below. The section is written in an abbreviated sentence style (telegraphic) for brevity, as descriptions of species were kept as simple and short as possible, due to word limits for each treatment. However, the frequent use of technical terminology for fishes is unavoidable without the repetitive use of long phrases. Readers should refer to the illustrated glossary (Chapter 6) for an explanation of terms with which they are unfamiliar.

The subsection provides information on each species, including aspects of disc and body shape, snout and oronasal regions, denticle shapes, and relative fin positions and dimensions. Core measurements such as 'disc width' and 'total length' are abbreviated throughout the treatments as 'DW' and 'TL' respectively. Differing terminology for measurements (i.e. snout, preoral, orbital, precloacal, procaudal lengths, etc.) are explained in the Glossary. Proportions were expressed as either percentages or as ratios (rounded to the nearest 0.1).

Counts of tooth rows and vertebrae are patchy across most ray groups; these data can be obtained by radiographs and extracted from published descriptions (where methodologies were consistent with those used here). While counts

presented are often based on few specimens, and as such constitute incomplete ranges, where they exist they provide important information for taxonomic specialists. The vertebral column of rays consists of two main types of vertebrae: monospondylous (relatively large centra of the trunk) and diplospondylous (smaller centra supporting the tail and sometimes the caudal fin). Total counts include all vertebrae from the rear of the cranium to the extremity of the tail or caudal fin (tip of upper lobe). In some rays, counts are taken to the first dorsal-fin origin (e.g. skates) or caudal sting (e.g. stingrays) because tail vertebrae (caudal counts) in the caudal fin and near the tail tip are often difficult to see. In some rays, the caudal fin is absent or the tail tip may be damaged, so monospondylous vertebral counts (trunk) and/or predorsal tail counts (diplospondylous vertebrae to the first dorsal-fin origin) are generally used. In rhinobatids, anterior pores of the vertebral column were not counted herein as centra. Other counts include number of radials in the pectoral fin and tooth rows in the jaws. Tooth row numbers are usually similar in both jaws for most rays; however, upper jaw counts are given preferentially when available. For stingrays, counts of small fleshy papillae on the floor of the mouth can be important for distinguishing species.

Colour

Colour tone and markings on the skin are particularly important for identifying species in most groups so, where possible, we have tried to describe their living coloration. While spots and subtle colour patterns are sometimes barely detectable after death, coloration in some rays remains life-like even after many years of preservation. The colour of the dorsal surface, its tone (e.g. brownish reddish, yellowish, etc.) and whether it is plain or marked (e.g. spotted, blotched, banded, reticulated, etc.) are very informative. The colour pattern and positions of these markings are also helpful for distinguishing species. Members of several groups (e.g. skates, electric rays and wedgefishes) have a pair of markings (blotches, spots or ocelli) on the central bases of the pectoral fins that vary in prominence between species, and can change with age and sex within species.

Coloration of the ventral surface also varies greatly between species. Some rays are almost entirely white below, whereas others are almost uniformly dark, or pale centrally with dark markings along the margins of the disc and pelvic fins (some skates). The sensory pores of some skates are black-edged, and/or surrounded by dusky patches. Several guitarfishes and wedgefishes have large dark blotches on the ventral snout tip.

Size

Realistic maximum attainable sizes are known for very few ray species. Information provided in this book is based on available data and is indicative rather than precise. Baseline data are needed across all geographic regions to fill these information gaps. Sizes are generally expressed as total lengths (TL) and measured as a straight line from the snout tip to the tip of the extended tail. In some ray groups (Dasyatidae, Potamotrygonidae, Gymnuridae, Myliobatidae, Rhinopteridae and Mobulidae), where the tail is narrow and/or frequently damaged, the size measurement used instead is disc width (DW); total lengths may be also provided to give an indication of the attainable length. Additional to maxima, sizes at birth or hatching and at sexual maturity are given for each species when known. Data in the literature vary greatly in quality due to misidentification of species, comprehensiveness, methodological considerations, and research effort. Data may also vary within a species from one region to another. Hence, we hope information provided in this guide will encourage readers to help fill these gaps across families, genera and species.

Map

A schematic representation of a species' distribution is provided in an accompanying map, usually represented as a range, but if its distribution is patchy or rare, then as discrete locations. If more precise point distribution information is needed, readers should consult other sources, such as maps on the Tree of Life (http://sharksrays.org) or the IUCN Red List of Threatened Species (http://www.iucnredlist.org) websites. Maps fit a discrete layout window based on a standard world map (using a Mercator projection). When species have narrow ranges, or are confined to smaller regional or oceanic scales, various subdivisions of the standard map are used. Distributions are marked as red polygons. Readers can make valuable contributions to extending and refining the knowledge of species' distributions beyond their documented confines.

Habitat and biology

This subsection is prefaced with the generalised distribution of a species; usually the ocean basin(s) where it occurs, identifying the end points of its known range by country or geographic landmark. Questionable distributions are discussed when necessary. Other details provided in this section may include information on a species' spatial habitat, depth range, and general aspects of its biology and life history, including reproduction and diet when known.

Similar species

This informal section identifies close relatives or species that are similar in appearance or co-occur in the same region. Comments provided are necessarily brief due to space constraints so readers should cross-reference treatments of species discussed. In certain cases, scientific names in regular use and now placed in synonymy, are discussed briefly. Recent changes to higher level classification, e.g. generic changes, are also mentioned here.

Fig. 5.3. Fish collections provide major sources of information on ray diversity. (Carlie Devine)

Conservation status

The IUCN Red List of Threatened Species is the most comprehensive approach devised for evaluating the conservation status of the world's plant and animal species. Underpinned by scientific evidence, it is designed to assess relative extinction risk and highlights species at risk of extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List Categories and Criteria have been discussed in Chapter 4. The current conservation status of each species is demarcated by a logo beside the image. Abbreviations for these criteria in order of decreasing threat are: EX, Extinct; EW, Extinct in the Wild; CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; LC, Least Concern; DD, Data Deficient; and NE, Not Evaluated.

COLLECTION AND FIXATION OF SPECIMENS

Many species of rays are rare or poorly represented in collections, particularly those living in deep water in relatively unexplored regions or where fishing effort is limited. Wherever feasible, specimens that cannot be identified using this book or which are considered rare, should be donated to a regional museum or fisheries department. Specimens should be either frozen or preserved in 10% formalin solution (1 part formaldehyde concentrate to 9 parts water). Formalin can be usually obtained from pharmacies, chemical distributors or agricultural suppliers in most countries, although permits are sometimes needed. Formalin is a poisonous liquid with a pungent odour and should not be inhaled or allowed to come into contact with skin. When used frequently, it should be handled only while wearing a face mask with appropriate filter and chemical resistant gloves. For rays that are too large to preserve whole, good photographs should be taken of the entire fish in dorsal and ventral views, as well as close ups of the oronasal region, and any denticle or thorn patches on the disc and tail. Lateral profile images should be taken of rays that have small discs, such as guitarfishes and their allies. As well as images, a small tissue sample (~5 mm^3 taken from deep inside the centre of the right pectoral fin) should be retained for genetic identification; this can be stored in 95% analytical-grade ethanol or frozen, but should never be placed in formaldehyde as this will destroy the DNA. For rays too large to keep, tissues, jaws, claspers and tail can be removed and retained. Capture details of specimens, such as collection date, size, sex, locality, depth, captor and method of capture, should be recorded in each case. Arrangements usually need to be made prior to sending or donating material to recipient scientific institutions and museums. In some cases, appropriate animal ethics and collection permits must be obtained.

CHECKLIST OF THE WORLD'S RAYS

The species content of this book is summarised in a checklist of the world's ray fauna (see end of book). Members of the 26 ray families are listed in alphabetical order according to their assignments within the four batoid orders (not following strict evolutionary sequence): Rhinopristiformes (Pristidae to Zanobatidae, Chapters 8–14), Torpediniformes (Narcinidae to Torpedinidae, Chapters 15–18), Rajiformes (Rajidae to Anacanthobatidae, Chapters 19–22), and Myliobatiformes (Hexatrygonidae to Mobulidae, Chapters 23–33). Species distributions are demarcated (with a cross) according to their occurrences within 18 broad-scale biogeographic regions (see figure with checklist, p. 756): Eastern North Pacific (ENP), Eastern Central Pacific (ECP), Eastern South Pacific (ESP), Western South Atlantic (WSA), Western Central Atlantic (WCA), Western North Atlantic (WNA), Eastern North Atlantic (ENA), Mediterranean Sea (MED), Eastern Central Atlantic (ECA), Eastern South Atlantic (ESA), Western Indian Ocean (WIO), Northern Indian Ocean (NIO), Eastern Indian Ocean (EIO), Western South Pacific (WSP), Western Central Pacific (WCP), Western North Pacific (WNP), Arctic (ARC), and Southern Ocean (SOC). A depth range is also provided for each species when known.

The distributional component of the checklist is designed to assist with species identification; each ray species' regional distribution can be determined from the checklist. Knowing a family/genus group and the region in question, an identifier can quickly view the checklist to find a suite of likely species and then view the pages for those species to find their ray. Occasionally, species will be found outside their demarcated regions. If so, such discoveries are significant as they will extend the known range of the species and should be reported to relevant specialists or museums.

REFERENCES

Published literature on the taxonomy, distribution and biology of rays is exhaustive, so we have not attempted to cover this comprehensively. However, a short section is provided at the end of the book outlining major literary works whose content has been used exhaustively in the preparation of this guide. The section is divided into five reference categories: selection of general works on rays, and then major references considered important for families in each of the four higher-level ray groups (i.e. Orders Rhinopristiformes, Torpediniformes, Rajiformes and Myliobatiformes). Scientific papers prepared especially for this book and published in the journal *Zootaxa* this year are prefixed with an asterisk. These studies present new information and formally name undescribed species of rays. Other papers not listed that are presently in preparation, discuss the many nomenclatural decisions taken by authors when researching the book.

6
GLOSSARY

G.K. Yearsley & P.R. Last

abdomen (adj. abdominal) – the part of the body that contains the digestive and reproductive organs; the lower part of the body in front of the cloaca.

abdominal vertebrae – elements of the vertebral column (i.e. monospondylous centra) from the cranium to the tail origin (near end of cloaca).

aberrant – unusual in form or behaviour, abnormal.

abruptly angular – angular tip of structure.

abyssal plain – the ocean bottom from about 2000 to 6000 m depth; the upper abyssal plain (2000–4000 m) is also often referred to as the continental rise (fig. 6.20).

acuminate – tapering to a point.

acute – sharp or pointed.

acutely rounded – angular structure with extremity of its tip rounded.

adipose – fatty.

adolescent – almost sexually mature; stage evident in males by slightly enlarged but not fully developed clasper.

adult – fully developed and sexually mature; stage evident in males by appearance of enlarged clasper.

advance (in advance) – in front of.

alar thorns – symmetrical patches of thorns on the outer disc of most mature male skates (fig. 6.2).

alimentary canal – the passage through which food passes and is digested and absorbed; includes the oesophagus, stomach and intestine.

allopatric – populations or species occupying mutually exclusive geographic areas.

ampullae of Lorenzini – sense organs comprised of a network of external pores, mucous-filled canals and innervated ampullae connected to nerves; includes the acoustico-lateralis and electroreception systems.

angular – forming a distinct angle.

anterior (adv. anteriorly) – relating to the front of or head end of an object (fig. 6.18).

anterolateral – pertaining to the direction or position between the front and side of an object.

antitropical – found in both hemispheres but not in equatorial regions.

antorbital – relating to the area immediately anterior to the eyes.

antorbital cartilages – cartilages attached to and connecting the sides of the nasal capsules of the cranium and anterior fin skeleton; help provide support for the head.

antrorse – turned forward or upward.

apex (adj. apical) – the tip, pointed end or extremity, often in reference to a fin (fig. 6.9).

apical lobe – small fleshy lobe at the snout tip of some rays.

aplacental – a form of viviparous reproduction where no placenta is formed but the method of embryonic nutrition is unknown.

appendage – a major projection from the body of an animal.

arcuate – curved, shaped like a bow.

articulating – united by means of a moveable joint.

asymmetrical – not symmetrical; one side is not the mirror image of the other.

axil – the point of insertion or the angle formed by the inner edge of a fin and the body at the point of attachment.

backward (backward of) – behind.

bar – see *saddle*.

basal – at or towards the base.

base – the part of a projection (often a fin) connected to the body (fig. 6.17).

bathyal – benthic habitats from 200 to 4000 m depth.

bathypelagic – living in the water column above the bottom in the deep ocean at depths of between 1000 and 4000 m (fig. 6.20).

behind – refers to the posterior placement of one part of a fish relative to another (i.e. along the horizontal axis); should not be confused with beneath.

bell-shaped – resembling a bell, refers to the shape of the nasal curtain or snout undersurface.

below – sometimes used to refer to ventral (or lower) surface.

beneath – refers to the placement of one part of a fish relative to another (i.e. one underneath the other).

benthic – living mainly on the bottom or seafloor; applies to freshwater systems as well as the oceans.

benthopelagic – living in the water column mainly near or just above the bottom.

bi – prefix meaning two.

bicuspid – with two cusps or projections.

bifid – having two ends; split into two parts.

bifurcated – split or divided into two parts; bifid.

bilobate – having two lobes.

biogeographic – relating to the study of the geographical distribution of organisms.

blotches – variably sized, undefined markings, often large, irregular in shape and often with diffuse edges (usually different in colour to adjacent skin).

body – the portion of a ray other than its head; bordered anteriorly by the last gill opening.

bone (adj. bony) – hard calcareous substance that makes up the skeleton of most fishes.

border – margin, edge.

brackish – refers to water having a salt concentration between that of freshwater and seawater (usually 0.5–30 parts per thousand of salt).

broadly rounded – margin evenly convex, with tip not forming an angle.

buccal – pertaining to the mouth cavity.

bulbous – a shape, swollen or bulging.

buoyancy – the ability to float, rise or sink in water.

bycatch – the component of the catch (often discarded) excluding the targeted commercial species.

canine tooth – an enlarged jaw tooth, conspicuously longer than others nearby; adapted for holding prey.

carinate – having a keel or ridge.

carnivorous (n. carnivore) – preying on other animals.

cartilage – a skeletal material consisting of a matrix of soft, white or translucent chondrin.

caudal – pertaining to the tail region.

caudal fin – the tail fin (figs 6.1, 6.7).

caudal keel – a longitudinal fleshy ridge along the side of the caudal peduncle.

caudal sting – enlarged, serrated, dagger-like bony structure on the tail of some rays; sometimes abbreviated to 'sting' (figs 6.1, 6.7).

caudal vertebra (pl. – vertebrae) – centrum of the caudal fin.

centrum (pl. – centra) – main cartilaginous part of a vertebra, supporting haemal and neural arches.

cephalic – pertaining to the head.

cephalic lobe – broad lobe on the forehead of some rays (e.g. mobulids).

cephalopod – animal group including the cuttlefishes, squids and octopi.

ceratohyal-hyomandibula – paired cartilages of the hyoid arch, just behind jaws, which function in lower jaw mechanism and suspension from cranium.

ceratotrichia – slender, elastic, fibre-like structures made of protein that support the fins.

cerebellum – part of the brain that regulates and coordinates muscular activity.

chimaera – a Holocephalan fish, includes chimaeras, ghost sharks, spookfishes and elephant fishes.

chin – the anterior part below or immediately behind the lower jaws.

chondrichthyans – major group of fishes including the sharks, rays and chimaeras.

circular – shape resembling an evenly rounded disc (fig. 6.8).

circumglobal – distributed around the world within a range of latitudes.

circumtropical – distributed throughout the tropics.

claspers – modified reproductive parts of the pelvic fins in male sharks, rays and chimaeras used for transferring sperm to the female; enlarged and paired in adults.

cloaca – a common opening for digestive, urinary, and reproductive tracts in many fishes (fig. 6.1).

common name – the informal vernacular name for a fish (or other organism), which may vary from place to place.

compressed – flattened laterally, from side to side.

concave – hollowed out, curved inwards (opposite of convex).

confluent – joined together.

conical teeth – teeth shaped like a cone.

conspecific – individuals or populations of the same species.

contiguous – touching at edges but not actually joined.

continental shelf – the shelf-like part of the seabed adjacent a continent; extends from the coastal fringe to a depth of about 200 m (fig. 6.20).

continental slope – the often steep, slope-like part of the seabed bordering the continental shelf and extending offshore to a depth of about 2000 m (fig. 6.20).

continuous – not interrupted; a fin not divided into two portions.

convex – arched, curved outwards (opposite of concave).

copepod – small crustaceans of the subclass Copepoda; abundant component of plankton.

corrugation – alternating furrows and ridges.

cosmopolitan – having a worldwide distribution.

cranial – pertaining to the skull.

cranium – the part of the skull containing the brain, also known as neurocranium.

crenate – having a margin shaped into small rounded scallops.

crenulate – see *crenate.*

crescentic – shaped like the new moon.

Cretaceous – a period of geological time within the Mesozoic Era from about 145 to 65 million years ago.

cross-section – section through a structure; usually refers to tail of some rays where cross-section can be circular or oval (variably compressed or flattened).

crustaceans – major group of animals, including crabs, shrimps, prawns, lobsters and crayfishes.

cryptic – applied to fishes that live amongst sheltering and concealing cover, or that have protective coloration; also relates to species that have been confused with a close relative(s).

cusp – a projection on a tooth.

cusplet – small cusp.

cutaneous – pertaining to the skin or dermal structures.

Danish seine – a method of boat seining with a large net, but landing the catch on the vessel.

deciduous – easily shed or rubbed off; usually referring to denticles.

demersal – living on or near the seafloor; incorporates both benthic and benthopelagic organisms.

dendritic – branched, shaped like a tree.

dentate – bearing teeth or tooth-like projections.

denticle – type of scale (placoid) of a cartilaginous fish; herein, with reference to small spinules or granules on the skin (enlarged modified denticles found in some rays are referred to as scutes, thorns and tubercles).

denticle band – variably demarcated patch of denticles on the dorsal disc of many stingrays; the shape and extent of these bands usually varies between and within species as individuals grow and develop (fig. 25.4).

denticulate – with small, tooth-like projections.

depressed – dorsoventrally flattened; flattened from top to bottom.

depth (adj. deep) – height of body or head from dorsal to ventral surface, or a fin from its base to its apex (also called height, fig. 6.17); also refers to the distance below the sea surface in which a fish lives.

dermal – pertaining to the skin.

dermal denticle – see *denticle.*

dermal flaps – skin outgrowths.

Devonian – a period of geological time within the Palaeozoic Era from about 419 to 359 million years ago.

dichromatic (n. dichromatism) – having different colour patterns within a species; usually related to sexual or growth differences.

dimorphic (n. dimorphism) – existing in two forms; usually refers to differences between the sexes in body shape and/or colouring.

diphycercal – caudal-fin shape that is primitively symmetrical and pointed.

diplospondylous – having two vertebrae in each body segment, particularly in the tail region of certain fishes (fig. 6.12); diplospondylous centra are smaller than monospondylous centra.

direct length – shortest distance between two points.

disc – the combined head, trunk and enlarged pectoral fins of many rays (fig. 6.8).

disc apex – see *pectoral-fin apex*.

dispersal – the spread of organisms from their original location by active means.

distal – region, border or point remote from the site of attachment (opposite of proximal).

DNA – the main component of chromosomes (deoxyribonucleic acid), responsible for transfer of genetic information.

dorsal – pertaining to the upper part or surface of back (fig. 6.1).

dorsal fin – an unpaired fin on the back or upper tail (figs 6.1, 6.7).

dorsal skin fold – fold of skin along the dorsal mid-line of the tail in some rays; variably developed in stingrays, often short-based and low (fig. 6.7).

dorsolateral – part of the body or a structure positioned or angled midway between the tip and the sides; positioned or orientated between the dorsal and lateral surfaces.

dorsoventral – referring to a specific direction, from top to bottom.

dropline – a deepwater fishing method involving the use of a vertical line bearing rows of baited hooks.

duct – small tube or canal through which some material (e.g. a secretion) is conveyed.

dusky – somewhat dark or greyish in colour.

ecomorphological – refers to the relationship between an organism's ecological role and its morphological characteristics.

ectoparasite – a parasite that lives on the outside of another organism (its host).

egg capsules – see *egg case.*

egg case – strong casing surrounding the fertilised eggs of some sharks, skates and chimaeras (fig. 6.6); in rays, a protective case made of collagen fibres used to protect the developing embryo (also known as egg capsule or mermaid's purse); flattened and rectangular in shape and laid on the seafloor.

elasmobranch – member of a major group of fishes including the sharks and rays.

electric organ – organ capable of delivering an electric shock.

electrocyte – a specialised muscle cell responsible for generating electricity.

electrogenic organs – electricity-producing organs, well developed in electric rays.

element – a ray or spine of a fin (see also *radial*).

elevated – higher.

elevated fin – some part of a fin higher than the adjacent parts of the fin or body.

elliptical – shaped like an ellipse, oval.

elongate – drawn out or extended in length relative to some other criterion (usually depth).

emarginate – with the margin slightly hollowed.

embryo – unborn or unhatched offspring in the process of development.

embryonic – relating to the embryo.

endemic – native and restricted to a defined area.

endoparasite – a parasite that lives inside the body of another organism (its host).

entire – with a continuous margin.

Eocene – an epoch of geological time within the Quaternary Period from about 56 to 34 million years ago.

epipelagic – the upper part of the ocean from the surface to about 200 m depth (fig. 6.20).

epithelium – a thin layer of tissue on the outer body or body part (e.g. covering the caudal sting).

epithet – second part of a scientific name, part that refers to the species name.

erectile – capable of being raised or erected.

estuarine – living mainly in estuaries.

euphausids – a group of small, pelagic, shrimp-like crustaceans.

euryhaline – able to live in a wide range of salinities.

excised – with the margin cut out, or concave.

extinction – the end of or dying out of a species or other taxonomic unit.

eyelid – moveable, muscular fold of skin capable of covering all or part of the exposed portion of the eyeball.

falcate – curved like a sickle.

family – one of the major categories in animal and plant classification; contains one or more closely related genera.

fauna – the communities of animals in an geographic area.

fertilisation – the union of male and female cells to form a new individual.

filament (adj. filamentous) – a thread-like process or appendage; often applied to the thin tails of rays (i.e. stingrays and some skates).

filter feeding – filtering suspended food particles from a water current by means of the gill rakers.

fimbriate – with a fringed margin.

firm – relating to body hardness; opposite of flabby.

flabby – relating to body hardness, soft; opposite of firm.

fork length – length of a fish measured from the snout tip to the centre of the caudal fin.

forked caudal fin – a caudal fin with a deeply concave or excavated hind margin.

formalin – fixative (preservation solution), comprised of a mixture of concentrated formaldehyde and water.

fossa – a groove or pit.

free rear tip – posterior tip of a fin closest to the fin insertion (fig. 6.9).

fringe – edge adorned with fine tassels (e.g. posterior margin of nasal curtain of some rays) (fig. 6.3).

front – anterior position.

funnel – component of the clasper in some skates (fig. 6.5).

fusiform – spindle-shaped, tapering at both ends.

gape – the expanse of the open mouth.

gelatinous – like jelly.

genetic – relating to genes and their characteristics.

genome – a complete or full set of chromosomes from an individual; these chromosomes represent an organism's inherited characters and traits.

genus (pl. genera) – a major group term used in classifying organisms; contains one or more related species.

gestation – the time and development of young within a mother.

gill – organ for breathing or extracting oxygen contained in water.

gill arch – a cartilaginous arch bearing the gills.

gill opening – see *gill slits.*

gill slits – long, narrow openings on the ventral head in rays; respiratory pathway between the gill chamber and the exterior environment (fig. 6.1).

gillnet – a net used to tangle or snare fishes.

globular – blob-like, shaped like a globe, spherical; with reference to denticle shape.

gonad – the organ containing the reproductive tissues; ovaries in females, testes in males, both in hermaphrodites.

graball net – gillnet.

granular – a rough or grainy surface.

granulations – fine dermal denticles (fig. 6.7).

gregarious – tending to live in groups.

habitat – the locality with its own particular environment in which an organism lives.

head – specialised anterior part of an animal on which the mouth and major sensory organs are located; part other than the trunk and tail; measured from the snout to the posterior gill slit (figs 6.1, 6.19).

head length (ventral) – direct distance on the ventral (lower) surface of the head from the tip of the snout to anteriormost point of the fifth gill slit (fig. 6.19).

heart-shaped – disc shaped like an inverted heart (fig. 6.8); also refers to shape of a dermal denticle or thorn.

heterocercal – caudal fin shape with unequal lobes, the upper lobe being larger than the lower.

holotype – a single specimen designated as the 'type' (i.e. name bearer) of a new species by the author(s) of the original description.

horizontal length – distance between two points measured parallel to the longitudinal axis of the fish.

horny – hard or solid form.

hyaline – transparent.

hyomandibular pores – line of enlarged pores extending posteriorly from the mouth corners.

hypocercal – caudal fin shape in which the lower lobe is larger and often more posteriorly directed than the upper lobe.

imbricated – overlapping, like shingles.

incised membrane – membrane having a notch or with a concavity between supports.

indented – refers to a structure with a small notch in the middle.

indigenous – native to, but not necessarily limited to, a defined geographic area.

inferior – lower (opposite of superior).

inflatable – capable of expanding in volume.

infra – prefix meaning below.

infraorbital – the area below the eye.

inner corner – corner or angle of pectoral fin closest to body; see also *free rear tip.*

inserted – refers to the most posterior position of a fin base; usually with reference to another structure.

insertion (of fin) – posterior point of attachment of a fin to its base (e.g. see pectoral-fin insertion on fig. 6.1).

integument – covering, skin.

inter – prefix meaning between.

interbreeding – breeding between groups or populations of animals.

intercalated (thorns) – usually refers to a row of small thorns inserted between larger ones.

interdorsal – the space on the dorsal surface between the first and second dorsal fins; measured from the point of insertion of the first to the origin of the second.

interdorsal ridge – ridge of skin between first and second dorsal fins.

internarial space – see *internasal space.*

internasal flap – see *nasal curtain.*

internasal space – distance between the nostrils; area between the nostrils.

interorbital distance – the shortest distance, or width, between the eyes.

interorbital space – the area on top of the head between the eyes.

interspace – area between two given features.

interspecific – between separate species.

intraspecific – within one species.

iridescent – displaying a wide range of changing and often brilliant colours.

irregular – opposite of regular.

isopod – small crustaceans of the order Isopoda, typically with dorsoventrally flattened bodies.

jaws – part of the mouth supporting the teeth; in chondrichthyan fishes, articulated calcified cartilages comprising the palatoquadrate (upper jaw) and Meckel's cartilage (lower jaw).

jugular – related to the throat.

Jurassic – a period of geological time within the Mesozoic Era from about 200 to 145 million years ago.

juvenile – young fish, mostly similar in form to adult but not yet sexually mature.

keel – a fleshy ridge; usually relates to a skin fold on the caudal peduncle.

labial – pertaining to the lips.

labial folds – folds of skin on lips, adjacent to mouth.

labial furrows – shallow grooves around the lips.

labyrinth organs – the inner ears, responsible for hearing and balance.

lanceolate – broad at base and tapering to a point; spear-shaped or lance-shaped.

lateral – referring to the sides (fig. 6.7).

lateral keel – prominent ridge along the side of the body.

lateral skin fold – fine fold of skin along the side of the tail of some rays (fig. 6.7).

life cycle – the generalised history of a species from birth to death.

life history – the full range of biological changes, habits, and behavior of an animal or plant over the course of its life.

linear – in a line.

lip – fleshy outer portion of jaws (fig. 6.3).

lip groove – see *labial furrows.*

lobate – divided into lobes.

lobe – a rounded outgrowth (fig. 6.7).

longitudinal – lengthwise (opposite of 'transverse').

longline – a fishing line often of considerable length bearing numerous baited hooks that is usually set horizontally in the water column.

lozenge-shaped – shaped like a rhombus.

lumbar – upper central disc immediately forward of cloaca, over abdomen.

lunate – shaped like a crescent moon.

malar thorns – lateral patches of thorns beside the eyes of mature male of many skate species (fig. 6.2).

margin – edge, rim.

matrix – an embedding or enclosing substance.

matrotrophic – method of embryonic nutrition in viviparous species where nutrients are transferred from the mother.

medial – on or towards the middle of the body.

medial cartilage – support cartilage of the snout of some rays (often obvious on the mid-line of the snout as a ridge, also known as rostral cartilage) (fig. 6.1).

median – pertaining to the middle.

median thorn row – continuous or broken row of thorns on the mid-line of the disc and/or tail (fig. 6.2).

membrane – the thin layer of tissue covering a part of an animal or connecting the fin elements.

meristics – countable features (e.g. tooth rows, fin radials or vertebrae).

mesopelagic – living in the open ocean at depths of between 200 and 1000 m (fig. 6.20).

Mesozoic – an era of geological time from about 250 to 65 million years ago, including Triassic, Jurassic and Cretaceous periods.

migration – movement from one area of inhabitation to another.

mitochondrial DNA – DNA found in the mitochondria of cells; inherited through the female line only.

mitochondrial gene – a gene of the mitochondrial chromosome; CO1 and NADH2 genes have been used widely for barcoding sharks and rays.

molecular – relating to or consisting of molecules; molecular research focuses on the form and function of components of living cells, including DNA and proteins.

monophyletic – relating to a taxonomic group that contains all descendants of a common single ancestor.

monospondylous – having a single vertebra in each body segment, as in the trunk of certain fishes (fig. 6.12); centra are larger than diplospondylous centra.

monotypic – including only a single species.

morphology (adj. morphological) – pertaining to the physical form and structure of an animal.

mouth – the opening through which food enters the alimentary canal (figs 6.1, 6.3).

mucous gland – a gland secreting mucus.

mucous membrane – a membrane secreting mucus.

mucous pores – see *sensory pores.*

mucus (adj. mucous) – a slimy solution of mucin or other viscous substances.

multicuspid – with multiple tooth cusps.

multiserial – arranged in several rows.

myomere – a muscle segment of the body, separated from adjacent segments by connective tissue.

mysids – a group of small, pelagic, shrimp-like crustaceans.

naked – skin smooth, without dermal denticles (enlarged dermal structures such as thorns can be present); skin totally lacking dermal structure is 'entirely' naked.

nape – mid-region of the head behind the eyes and spiracles.

narial – see *nostril*.

narrowly rounded – margin narrowly convex, with tip not forming an angle.

nasal capsule – cartilaginous envelope at the anterior part of the cranium housing the nasal organs.

nasal curtain – a fleshy apron extending between the nostrils and partly covering the mouth of some rays and sharks (figs 6.1, 6.3, 6.13); formed by the partial or complete fusion of the anterior nasal flaps.

nasal flap – see *nasal curtain*.

nasal lobe – prominent skin fold beside the nostril.

nasal organs – sensory structures for detecting smell; usually appearing externally as one or two pores or slits on each side of the fish.

nasal tentacle – fleshy protrusion near the nasal pores or nostrils.

nasoral groove – see *oronasal groove*.

neonates – see *newborns*.

neotropical – relating to the geographic region containing Central and South America, and including parts of southern and coastal Mexico and the Caribbean.

neritic – the shallow pelagic zone over the continental shelf (fig. 6.20).

newborns – recently born individuals.

niche – the role or specialised position of an organism in its environment.

nomenclature – the systematic naming of animals and plants.

nostril (adj. nasal, narial) – external opening of the nasal organs (figs 6.1, 6.3).

notch – furrow on the caudal peduncle just in front of the caudal fin; also a concavity or scalloped area of a fin (fig. 6.10).

notched fin – a groove or dip in the profile of a fin.

nuchal – pertaining to the nape; nuchal thorns are those on mid-nape (fig. 6.2).

obsolete – a taxonomic character that is disappearing or scarcely evident.

obtuse – broadly rounded, having a blunt end.

oceanic – living in the open ocean.

ocellus (pl. ocelli) – an eye-like spot or marking with a marginal ring.

ocular – related to the eye.

oesophagus – beginning of the digestive tract, between the mouth and the stomach.

ontogeny (adj. ontogenetic) – the development or course of development of an individual organism.

opposite – object situated on the other or further side of another object; usually in the same longitudinal plane.

oral – pertaining to the mouth.

oral papillae – small fleshy structures on the floor of the mouth in some rays (e.g. stingrays).

orbit – bony cavity in skull where eyeball is housed; measurement of the orbit is usually taken as either the eyeball length or the length from the anterior edge of the orbit to the posterior edge of the eyeball, depending on the group.

organism – an organised body consisting of mutually connected and dependent parts constituted to share a common life.

origin (of a fin) – the most anterior point of a fin base (fig. 6.7).

oronasal groove – furrow in some sharks and rays connecting the mouth to the nasal organs; usually concealed beneath nasal curtain (fig. 6.3).

oronasal region – part of ventral head including mouth and nostrils (sometimes also with a nasal curtain) (fig. 6.3).

osmoregulation – process of adjusting blood concentration of sodium and nitrogen compounds (urea) to be in balance with the osmotic pressure of the environment.

otic capsules – cavities within the posterior cranium that contain the inner ears (labyrinth organs).

oval – disc outline more or less oval-shaped (fig. 6.8).

oviduct – a tube leading from the ovary to the cloaca or external genital opening along which the ova pass during spawning.

oviparous – producing egg cases that hatch after being ejected from the body of the parent female ray.

ovoid – egg-shaped.

ovoviviparity – previous term for yolk-sac viviparity, where developing embryos rely solely on yolk without additional nutrients from the mother.

Palaeozoic – an era of geological time from about 570 to 250 million years ago.

palate – the roof of the mouth.

palatoquadrates – in rays, calcified cartilage forming the upper jaw.

papilla (pl. papillae) – a small fleshy projection (fig. 6.3).

papillate – see *papillose.*

papillose – covered with papillae.

paraphyletic – relating to a taxonomic group that excludes some descendants of a common ancestor.

parasitic – living and feeding in or on another organism to the detriment of that organism.

paratype – a specimen, other than the holotype, on which the description of a new species is based.

pearl thorn – thorn resembling a hemisphere; half of a pearl in shape and colour.

pecten – cartilaginous component of the dorsal lobe of the clasper in some skates; consisting of 6 or more sharp, comb-like processes.

pectoral – pertaining to the breast.

pectoral fin – paired fins just behind or below the gill opening; united to form a disc in most rays (fig. 6.1).

pectoral-fin apex – lateral-most portion of the pectoral fins or disc.

pectoral girdle – the cartilaginous skeletal arch supporting the pectoral fins.

pectoral marking – distinctive feature of coloration (large blotch or ocellus) on the middle of each pectoral fin; usually only one large marking each side of disc.

pectoral-fin corners – see *pectoral-fin apex.*

pectoral-fin radials – also pectoral radials; cartilaginous elements of the pectoral fin, forming support for the disc in many rays (fig. 6.12).

pectoral–pelvic interspace – distance or area between pectoral-fin insertion and pelvic-fin origin.

pelagic – free-swimming in the seas, oceans or open water, not in association with the bottom.

pelvic fins – paired fins (rarely joined) positioned on the ventral surface between the head and vent; also referred to as ventral fins (figs 6.1, 6.10).

pelvic–anal interspace – distance or area between pelvic-fin insertion and anal-fin origin.

pelvic lobe – part of divided pelvic fin; consisting of anterior and posterior lobes in some skates (fig. 6.10).

perinasal – around the margin of the nostril.

phylogenetic – relating to the evolutionary history of a species or other taxon.

pigmented – coloured.

placed – refers to position of a structure on the body; often used for fin positions.

placentotrophic – method of matrotrophic embryonic nutrition in viviparous species where nutrients are transferred across the mother's uterine epithelium which is in intimate contact with foetal tissue (placenta).

placoid – modified scales or denticles in sharks and rays, and some extinct fishes; plate-like.

plain – uniformly coloured, without a contrasting colour pattern.

planktivorous – feeding on plankton.

plankton – small animals or plants that float or drift in open water.

plate tectonics – a theory describing the movement of continental plates across the Earth's surface.

plica (pl. plicae) – fold of skin.

plicate – when folds of skin are arranged to form a fan-shaped structure.

polychaete – diverse group of largely marine worms.

polyphyletic – relating to a taxonomic group where the members do not share a common ancestor.

population – a biological unit; representing the individuals of a species living in a particular area.

pore – a small secretory or sensory opening or pit.

postdorsal ridge – prominent cutaneous ridge behind a dorsal fin.

posterior (adv. posteriorly) – relating to the hind or rear portion; situated farther back than something else (fig. 6.18).

posterolateral – pertaining to the direction or position between the rear and side of an object.

postorbital – the region immediately behind the eye.

pre – prefix meaning in front of.

pre-oral – before the mouth.

pre-oral cleft – a deep groove extending forward from the lateral border of the mouth.

pre-sting length – distance forward of caudal sting origin; usually measured to edge of disc, cloaca or snout tip (fig. 6.19).

predator (adj. predatory) – feeding on other animals.

predorsal – area or distance anterior to first dorsal fin.

predorsal tail vertebrae – elements of vertebral column (i.e. diplospondylous centra) from tail origin (near end of cloaca) to first dorsal-fin origin.

predorsal vertebrae – elements of vertebral column from the cranium to the first dorsal-fin origin; sum of abdominal and predorsal tail vertebrae.

preorbital – the region immediately forward of the eye.

procaudal (length) – end of the tail in skates; measured as the distance from the origin of the first dorsal fin to the tail tip (fig. 6.18).

process – a natural outgrowth or projection of part of an organism.

produced – elongated or projecting.

projecting – extending beyond something else.

projection – a part that juts out.

promontory – component of the clasper in some skates (fig. 6.5).

protractile – capable of being drawn out or extended forwards.

protruding – structure elevated above or extended beyond surrounding surface, e.g. protruding eyes are raised above the head profile (opposite of sunken).

protrusible – a condition of the jaws in which the mouth projects forward as a tube when the mouth is opened.

protuberance – an outward bulge.

proximal – region, border or point adjacent to the place of attachment of a projection or appendage (opposite of distal).

pseudo – very similar or typical, but still an incomplete copy, e.g. a pseudo-ocellus is a marking vaguely resembling an ocellus.

puboischiadic bar – pelvic girdle.

pups – newborns.

purse seine – a fishing net used to encircle surface-dwelling fish; it is usually landed aboard a boat rather than beached.

quadrangular – shaped with four distinct edges or margins; see *rhombic*.

quadriradiate – with four radiating arms or extensions.

quincunx – multiple rows and series of flattened teeth arranged in pavement fashion.

radial – cartilaginous structural element of a ray's fin; counts of pectoral-fin radials can be useful for distinguishing species.

radiation – the spread of an organism utilising a new advantageous evolutionary feature or by means of adapting to a new environment(s).

radii – (sing. radius) a straight line from the centre of a circle to its outer edge (circumference).

raked – anterior margin of dorsal fin on an angle, usually pointing posterodorsally (fig. 6.9).

rectangular – with reference to shape of a structure (e.g. nasal curtain); like a rectangle, with approximately parallel opposite margins; often compared with skirt-shaped (fig. 6.13).

recurved – curved backwards.

reduced – see *rudimentary*.

reflexed – bent or turned backwards.

regular – evenly spaced, e.g. referring to colour features such as spots or to the arrangement of thorns in a row (i.e. evenly spaced and in a straight row); irregular features are not evenly arranged, e.g. thorns in an irregular row are not evenly spaced and/or in a discrete row.

respiratory – associated with breathing.

reticulated – divided into a network.

reticulations – markings in the general form of a net.

retrorse – pointing or curved backwards.

rhombic – diamond-shaped (fig. 6.8).

roll – component of the clasper in some skates (fig. 6.5).

rosette (thorns) – continuous or almost continuous row of thorns forming a half-ring around the orbit and spiracle rims of some rays (fig. 6.14).

rostral cartilage – a gristly structure supporting the snout (also known as medial cartilage) (fig. 6.1).

rostral shaft – the usually robust and obvious rostral cartilage of some rays such as guitarfishes.

rostral teeth – tooth-like projections on the sides of the snout of sawfishes and sawsharks.

rostral thorns – thorn or patch of thorns on upper snout of some ray species.

rostrum (adj. rostral) – a projecting snout; protracted anterior part of the skull or rostral shaft of some rays.

rounded – margin evenly convex.

row – sequential arrangement of a structure (e.g. thorns or spots); can be regular, staggered, evenly spaced, irregularly spaced, continuous, or discontinuous.

rudimentary – refers to incompletely formed or weakly developed structure; often becoming barely detectable.

rugose – rough.

saddle – a blotch extending across the dorsal surface from one side to another.

salinity – the concentration of salt in water.

scale (adj. scaly) – a small membranous or horny modification of the skin of many fishes.

scapular – the shoulder region (fig. 6.2).

scapulocoracoid – shoulder girdle.

school – a close aggregation of fish that swim in association with each other.

scientific name – the formal binomial name of an organism consisting of the genus and specific names; a species has only one valid scientific name.

secretory – involved in producing a secretion, or exuding a substance.

seine – a fishing net designed to hang vertically in the water, the ends being drawn together to encircle fish; to fish with a seine net (see also *purse seine* and *Danish seine*).

sensory – relating to the reception and transmission of a sense impression (e.g. sight, smell, touch, taste or hearing).

sensory canal – a tube beneath the skin connecting a series of sensory pores.

sensory pores – small to minute openings on the skin with a sensory function, usually connected beneath skin by canals (fig. 6.15).

serrate – saw-like.

sexual dichromatism – difference of colour between the sexes.

sexual dimorphism – difference of physical form (shape) between the sexes.

shield – component of the clasper in some skates (fig. 6.5).

shoulder region – part of a ray's body lying behind the head and above the scapulocoracoid (strong cartilaginous element supporting the pectoral-fin radials) (fig. 6.1).

Silurian – a period of geological time within the Palaeozoic Era from about 443 to 416 million years ago.

simple – singular, not divided into one or more branches.

skeleton – a structure whose main function is to strengthen and maintain the shape of an animal.

skin fold – an area where skin is bent over upon itself, forming a fleshy ridge (fig. 6.7).

skirt-shaped – broadening distally in the shape of a short skirt (e.g. the nasal curtain of some rays).

snout – that part of the head in front of the eyes; direct distance from the eye to the anteriormost tip of the head (figs 6.1, 6.19).

solitary – used in reference to a fish that occurs alone, not in schools or aggregations.

spatulate – broad and greatly flattened.

spawning ground – geographic area where reproduction takes place.

species – actually or potentially inter-breeding populations that are reproductively isolated from other populations; the basic rank of biological nomenclature.

species complex – a group of closely related species that are very similar to one another and have often been confused and/or thought to represent just one species.

speciose – rich in number of species.

spinular – relating to small spines or spinules.

spinule(s) – slender, sharp-tipped denticle.

spiracle – a respiratory opening behind the eye in sharks and rays (fig. 6.1).

spiral valve – a spiral structure in the intestines of some fish.

spot – a regularly shaped or rounded area (usually small in size) of a colour different from that of the area adjacent.

spots – variable size marking, usually almost circular or oval in shape.

stellate – star-shaped; with radial form.

stiffened – relating to tail hardness; opposite of flexible.

stinging spine – see *caudal sting.*

striated – marked with narrow lines or grooves, usually parallel.

stripe – a contrasting longitudinal pattern in the form of a line.

strongly – refers to a structure being well developed or represented.

sub – prefix meaning below.

subcutaneous – positioned beneath the skin.

subequal – not quite equal, almost equal.

subgenus – group taxon below a genus.

submarginal – nearly to or slightly inside of margin.

suborbital – area beneath the eye.

substrate – the substance forming the bottom of the sea or ocean floor.

subterminal – positioned near but not at the end of something.

sunken – structure not raised above surrounding surface, more or less embedded, e.g. sunken eyes are embedded within the head (opposite of 'protruding').

superior – upper (opposite of 'inferior').

supra – prefix meaning above.

suprascapular – region of the mid-shoulder; also refers to the dorsal-most part of the skeletal shoulder girdle.

suture – line of juncture of two parts.

swollen – enlarged, see *bulbous*; refers to the thickness of a structure (e.g. mid-tail of a skate) compared to nearby parts of the structure (fig. 6.11).

symmetrical – capable of being divided into two equal halves.

sympatric – living together in the same spatial or geographic area.

symphysis (adj. symphysial) – the junction of two bones; particularly relating to the medial junction of either the upper or lower jaw.

synarcual cartilage – tube-like cartilage formed by the fusion of anterior vertebrae; supports the disc and scapulocoracoid.

synonym (adj. synonymous) – each of two or more scientific names of the same rank used to denote the same taxon.

tail – the part of the fish between the vent and the tip of the caudal fin (figs 6.1, 6.7).

tail ridges – low and often hard fleshy structures along part or most of the tail in some rays; usually rudimentary skin folds.

taxon – any formal taxonomic unit or category of organisms (genus, species, family, etc.).

taxonomy – the science of classification of animals and plants.

teeth – hard outgrowths on the jaws, roof of the mouth or pharynx; used for biting and masticating food.

telencephalic – anterior and dorsal section of the brain.

teleost – member of a large group containing most bony fishes.

tendril – a slender, curling barbel.

terminal – situated at or forming the end of something.

tetrapod – a vertebrate with four limbs or with four-limbed ancestors.

thoracic – pertaining to the chest.

thorn – large dermal structure on the skin of many rays; tips vary from sharp to blunt; distinct from denticles (figs 6.2, 6.4).

thornlet(s) – small dermal structure appearing as a thorn, but often barely larger than a denticle.

tilted (thorn) – thorn with its crown on an angle, usually pointing posterodorsally (figs 6.2, 6.4).

tip – the extremity of part of a fish.

tooth crown – outer surface or part of a tooth; can be smooth, rough, corrugated, flat, pointed, etc.

tooth rows – horizontal rows of teeth along the jaws; difficult to count when the teeth are in quincunx (e.g. in rays).

total length – longest length of the fish, measured from the snout tip to the upper caudal-fin tip or tail tip (figs 6.16, 6.18, 6.19).

toxin (adj. toxic) – any poisonous substance of microbial, mineral, vegetable or animal origin.

translucent object – semi-transparent; an object that may transmit light but through which objects are not clearly visible.

transparent object – clear, an object not impairing light transmission or sight.

transverse – directed crosswise, across the width (opposite of longitudinal).

trawl – a fishing net that is dragged behind a boat; to fish with a trawl net.

tricuspid tooth – tooth with three cusps.

triradiate – with three radiating arms or extensions.

trophodermic – method of matrotrophic embryonic nutrition in viviparous species where nutrients are transferred across the mother's uterine epithelium that is not in intimate contact with foetal tissue.

truncate – terminating abruptly, as if cut off square.

trunk – that part of a fish (other than the fins) between the head and the tail; the region between the last gill opening and vent (fig. 6.19).

tubercles (adj. tuberculate) – either soft or hardened projections on the surface of the skin.

tubule – a small hollow, cylindrical structure.

undersurface – ventral (or lower) surface; usually refers to disc and/or tail.

undulate – having a wavy or rippled appearance; refers to the anterior disc margins of some rays (e.g. skates) (fig. 6.8).

uniserial – arranged in a single row.

united – joined together.

upright – anterior margin of dorsal fin almost vertical, directed more or less at 90 degrees to its base.

upright (thorn) – thorn with its crown directed more or less at 90 degrees to its base (fig. 6.4).

uteri (sing. uterus) – female organs where young develop before birth.

venomous – capable of producing a poisonous fluid that is transmitted by a bite or sting.

vent – the terminal external opening of the alimentary canal.

ventral – pertaining to the lower part or surface (figs 6.1, 6.16, 6.18, 6.19).

ventral fins – see *pelvic fins*.

ventral skin fold – fold of skin along the ventral mid-line of the tail in some rays; variably developed in stingrays, sometimes long-based and deep (fig. 6.7).

ventral terminal clasper cartilage – large cartilage on the ventral surface of clasper of some skates.

ventrolateral – positioned or orientated between the ventral and lateral surfaces.

vermiculations – a pattern of fine, wavy, worm-like lines or streaks of colour.

vertebra (pl. vertebrae) – bony or calcified cartilaginous segment of the backbone; composed of a centrum supporting neural and haemal arches in most vertebrates.

vertebral column – the backbone; consisting of monospondylous and diplospondylous centra.

vertebrate – member of a taxonomic group of animals with a backbone or spinal column.

vestigial – pertaining to the remaining part or indication of a structure that earlier was developed and functional.

villiform teeth – small slender teeth that form velvety bands.

viviparous – producing live young from within the body of the parent female.

vs. – abbreviation of 'versus', used to compare or contrast characters differentiating species.

weakly – refers to a structure being poorly developed or represented.

widespread – distributed over a wide geographic region, typically at scale of multiple ocean basins.

*Contents above are based on a glossary from *Sharks and Rays of Australia* (Last & Stevens 2009).

fig. 6.1 structural features of rays

fig. 6.2 thorn patterns

fig. 6.3 oronasal region

fig. 6.4 thorn shapes

fig. 6.5 clasper components

fig. 6.6 egg case

fig. 6.7 tail characteristics

undulate margin

rhombic

heart shaped

lozenge shaped

oval

circular

fig. 6.8 disc shapes

apex

free rear tip

falcate

rounded

triangular

fig. 6.9 dorsal-fin shapes

cloaca

posterior pelvic-fin lobe

anterior pelvic-fin lobes

notch

pelvic fin

fig. 6.10 pelvic-fin shapes (ventral view)

barely tapering

tapering evenly

bulbous and swollen

tapering strongly at sting

fig. 6.11 tail shapes

fig. 6.12 radiographs

broadly rectangular

narrowly rectangular

skirt shaped

fig. 6.13 nasal curtain shapes

incomplete row

rosette

fig. 6.14 orbital thorns

fig. 6.15 sensory pores

total length
snout length
head
trunk
tail
nostril length

fig. 6.16 wedgefish dimensions

fin length
height
base length
inner margin length

fig. 6.17 dorsal fin measurements

snout length
disc width
procaudal
total length
head
trunk
tail
anterior
mouth width
posterior

fig. 6.18 skate dimensions

snout length
disc width
disc length
total length
pre-sting length
head
trunk
tail

fig. 6.19 stingray dimensions

fig. 6.20 zones of the sea

7

KEY TO FAMILIES OF LIVING RAYS

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Some ray families (e.g. skates) can be difficult to distinguish based solely on external features. Skeletal characters, particularly details of the claspers, are very important in defining groups but these are usually too complex for general use. However, the key below incorporates at least some technical characters needed to distinguish genera (see figures and the Glossary for further explanation).

1. Posterior margin of pectoral fin well separated from anterior margin of pelvic fin (fig. 1); dorsal fins large and strongly falcate in adults (fig. 4); caudal fin with a long, narrow-based ventral lobe (fig. 3) or as short lobe (fig. 1) 2

   Posterior margin of pectoral fin overlapping anterior margin of pelvic fin (fig. 14); dorsal fins, when present, rounded (fig. 5) or angular (fig. 6), but not strongly falcate; caudal fin usually without a distinct ventral lobe (when present, as a low, more or less elongated extension, figs 15, 16) 3

2. Snout modified into an elongate, flattened, saw-like blade with enlarged teeth along lateral margins (fig. 1); cosmopolitan (range reduced) .... **Pristidae** (5 species; fig. 1, p. 58)

   Snout varying from short to relatively long and either broadly rounded (fig. 2) or acutely pointed (fig. 3); Indo–West Pacific and Eastern Atlantic .... **Rhinidae** (10 species; figs 2, 3, p. 65)

lobe

fig. 1

fig. 2

fig. 3

fig. 4
falcate

fig. 5
rounded

fig. 6
angular

dorsal-fin shapes

3. Body soft, entire disc nearly uniformly thick and rather flabby; large kidney-shaped electric organ on each side usually visible through the skin (fig. 7); body entirely naked (no denticles, thorns or caudal sting on dorsal surface of disc and tail) 4

   Body rather firm, disc variably thickened medially but progressively thinning toward margin (rarely flabby); no electric organs; denticles and usually thorns present on dorsal surface of disc and tail; caudal sting absent or present (fig. 51) 7

4. Mouth strongly arched with wide gape (fig. 8), without labial folds, grooves and/or cartilages at corners (fig. 8); 2 dorsal fins, first usually distinctly larger than second (fig. 16) 5

   Mouth nearly transverse, with prominent labial folds, grooves and cartilages at its corners (fig. 9); 1 or 2 dorsal fins (occasionally absent); dorsal fins of similar size when 2 are present 6

5. Disc length considerably longer than tail length (fig. 14); pelvic fins extending along most of tail (fig. 14); dorsal and caudal fins about same size (fig. 14); Australia .... **Hypnidae** (1 species; fig. 14, p. 182)

   Disc length about equal to or slightly longer than tail length (fig. 16); pelvic fins extending to about half or slightly more than half of tail length (fig. 16); caudal fin much larger than dorsal fins (fig. 16); cosmopolitan .... **Torpedinidae** (18 species; fig. 16, p. 184)

fig. 7

fig. 8

fig. 9

fig. 10

fig. 11

oronasal region

fig. 12

fig. 13

cartilages of cranium

fig. 14

fig. 15

fig. 16

6. Rostral cartilage of snout broad, stiff and shovel-shaped (felt by flexing snout, fig. 12); mouth surrounded by deep groove (fig. 10); teeth mostly visible on outer surfaces of upper and lower jaws (fig. 10); 2 dorsal fins always present (fig. 15); Indo–West and Eastern Pacific and Western Atlantic .... **Narcinidae** (30 species; fig. 15, p. 137)

   Rostral cartilage of snout narrow and rod-shaped (not felt when flexing snout, fig. 13); mouth surrounded by shallow groove (fig. 11); teeth of both jaws not extending onto outer surfaces of upper and lower jaws; tail with 1 or 2 dorsal fins (fig. 17), or fins absent; Indo–West Pacific and Eastern Atlantic .... **Narkidae** (9 species; fig. 17, p. 170)

7. Pelvic fins single lobed (fig. 18); adult males without a cluster of spiny alar thorns on each side of pectoral fins or disc 8

   Pelvic fins moderately to strongly bilobate (except in *Pseudoraja* and *Gurgesiella*), with a narrow anterior lobe and much broader posterior lobe (fig. 19); males with a cluster of alar thorns on each side of disc (except in some species of *Notoraja*) (fig. 20) 23

8. Tail relatively stout, usually broad based and flattened ventrally (figs 21, 27–29); 2 large dorsal fins and a prominent caudal fin (fig. 21); no caudal sting on tail 9

   Tail relatively slender, attenuated distally and barely flattened ventrally (figs 37, 48, 51); 1 rather small dorsal fin or none (fig. 37); a lobe-like caudal fin present and well developed (fig. 53), or absent (fig. 36) or rudimentary (fig. 62); caudal sting (figs 52–57) or remnant scar usually present on tail (no sting in some *Urogymnus*, *Aetomylaeus*, *Gymnura* and *Mobula*) 13

fig. 17

fig. 18

fig. 19

fig. 20

fig. 21

fig. 22

fig. 23

fig. 24

oronasal region

9. Disc broad and rounded, tail demarcated from disc (figs 21, 22); dorsal fins close together, first dorsal-fin origin usually about halfway between pelvic-fin insertion and caudal-fin origin (fig. 22); large and sharp thorns on head, shoulders and along mid-line of body (fig. 21) 10

   Disc typically narrow and wedge-shaped, tail not demarcated from disc (figs 28, 29) (disc broadly rounded and tail slightly demarcated from disc in *Trygonorrhina* and *Zapteryx*, fig. 27); dorsal fins usually well separated (by base length of first dorsal fin or more) (fig. 27); first dorsal-fin origin much closer to pelvic-fin insertion than caudal-fin origin (fig. 27); thorns absent or small and blunt (fig. 27) 11

10. Nasal flaps moderately expanded medially, separated by distance greater than twice width of anterior nasal opening (fig. 23); tail much longer than precloacal length (fig. 25); caudal fin relatively elongate (fig. 21); North Pacific and Indian Ocean .... **Platyrhinidae** (5 species; fig. 21, p. 127)

   Nasal flaps expanded medially, nearly connected (fig. 24); tail about equal to or only slightly longer than precloacal length (fig. 26); caudal fin short and deep (fig. 22); Eastern Central Atlantic .... **Zanobatidae** (2 species; fig. 22, p. 134)

11. Nasal flaps joined medially to form broad quadrangular curtain (fig. 30), or if well separated (*Aptychotrema*) nostrils orientated almost horizontally and mouth and upper lip distinctly curved (fig. 31); Australia and Western Atlantic .... **Trygonorrhinidae** (8 species; fig. 27, p. 117)

   Nasal flaps not forming a nasal curtain; nostrils relatively oblique and mouth and upper lip almost straight (figs 32, 33) 12

fig. 25

fig. 26

fig. 27

fig. 28

fig. 29

fig. 30

fig. 31

fig. 32

fig. 33

oronasal region

12. Nostrils long and narrow, length greatly exceeding internasal distance (fig. 32); anterior nasal opening rectangular (fig. 32); anterior cranium and base of rostral shaft dark and very sharply demarcated from rest of snout (much paler) (fig. 28); large to very large rays; Indo–West Pacific and Eastern Atlantic .... **Glaucostegidae** (6 species; fig. 28, p. 110)

    Nostrils not greatly elongated, length usually moderately exceeding internasal distance (fig. 33); anterior nasal opening circular or oval (fig. 33); snout uniform in colour, or margins separating snout and cranial cartilages diffuse (not sharply demarcated) (fig. 29); small to large rays; cosmopolitan .... **Rhinobatidae** (31 species; fig. 29, p. 77)

13. Head relatively deep, raised from disc and sides demarcated laterally from disc by a deep notch (fig. 34); eyes lateral on head (fig. 34); anterior part of pectoral fins modified at snout tip into single (fig. 34) or paired rostral lobes (figs 36, 37); dorsal fin small, close to or over pelvic-fin bases (figs 36, 37) 14

    Head not greatly thickened nor sides demarcated from disc by a deep notch (fig. 35); eyes dorsal or dorsolateral on head, distinctly inward of disc margin (fig. 35); no rostral lobes at snout tip (fig. 35); dorsal fin either absent or very small and usually positioned well behind pelvic-fin bases 17

14. Snout modified into a pair of elongated lobes on each side of head (fig. 36); mouth very broad and nasal curtain absent (fig. 38); jaws covered with very small cuspidate or hexagonal teeth (fig. 40); gills with filter plates .... **Mobulidae** (8 species; fig. 36, p. 741)

    Snout formed as a single, convex, lobe-like process (figs 41, 42) or pair of lobes (fig. 39); mouth narrow and nasal curtain present (fig. 39); jaws with broad plate-like teeth (figs 43, 44); gills without filter plates 15

15. Snout with a pair of broad lobes separated by deep notch (fig. 39); forehead expanded anteriorly and overhanging rostral lobes, profile deeply concave when viewed from above (fig. 37); 3 medial rows of broad plate-like teeth in each jaw, with additional 2–5 rows of smaller hexagonal teeth on each side (fig. 43) .... **Rhinopteridae** (8 species; fig. 37, p. 732)

    Snout with single, convex rostral lobe (figs 41, 42); forehead rounded and not expanded anteriorly or notched (figs 41, 42); single medial row of broad plate-like teeth in each jaw, with or without 3–5 additional rows of smaller hexagonal teeth on each side (fig. 44) 16

fig. 34

fig. 35

top of head

fig. 36

fig. 37

fig. 38

fig. 39

16. Tooth bands in single row in each jaw (fig. 44); upper tooth plate much broader than long (fig. 44); lower plate chevron-shaped, longer than broad (fig. 44) and projecting slightly forward of mouth (fig. 41); internasal flap with deep, v-shaped notch (fig. 41) .... **Aetobatidae** (5 species; fig. 46, p. 726)

    Tooth bands arranged in 6–10 rows in each jaw and fused into hard plate (fig. 45) (except in *Myliobatis goodei*); upper and lower tooth plates similar in shape (fig. 45) and lower plate not projecting forward of mouth (fig. 42); internasal flap not notched, rear margin almost straight (fig. 42) .... **Myliobatidae** (18 species; fig. 47, p. 706)

17. Six pairs of gill openings on ventral surface (fig. 49); body flabby; spiracles widely separated from eyes (fig. 51); Indo–West Pacific, South-East Atlantic and Eastern Pacific .... **Hexatrygonidae** (1 species; fig. 51, p. 509)

    Five pairs of gill openings on ventral surface (fig. 50); body firm (less so in Plesiobatidae); spiracles close to eyes (fig. 52) 18

18. Disc lozenge-shaped (fig. 48), very broad with pectoral fins laterally expanded, at least 1.6 times as wide as long; tail extremely short and slender (fig. 48); cosmopolitan .... **Gymnuridae** (10 species; fig. 48, p. 511)

    Disc oval to circular (fig. 55) or rhombic (fig. 56), usually less than 1.3 times as wide as long 19

fig. 40

mobulid tooth

rostral lobe

tooth plate

fig. 41

notched nasal curtain

not notched

fig. 42

undersurface of head

fig. 43

fig. 44

fig. 45

tooth plates (upper and lower jaws)

fig. 46

fig. 47

fig. 48

19. Caudal fin well-developed, elongate and lobe-like (figs 51, 53); tail relatively short and not whip-like (figs 51, 53) 20

    Caudal fin absent; tail often with skin folds or fleshy ridges on dorsal and/or ventral surfaces (fig. 56), usually more or less elongated, flexible and sometimes whip-like (fig. 55) 22

20. Snout long and flabby, length exceeding 6 times orbit length (fig. 52); nasal curtain short and broad, not or barely overlapping mouth (fig. 58); no oral papillae on floor of mouth; adults attaining nearly 3 m TL; Indo–West Pacific and Eastern Pacific ....
    .... **Plesiobatidae** (1 species; fig. 52, p. 674)

    Snout not flabby, length much less than 6 times orbit length (fig. 53); nasal curtain relatively long and narrow, usually overlapping mouth (fig. 59); oral papillae present (fig. 60); adults smaller than 1 m TL 21

21. Skin entirely naked (without denticles), except in *Spinilophus*; eyes relatively large (fig. 53); Indo–West Pacific .... **Urolophidae** (28 species; fig. 53, p. 676)

    Skin naked or covered with small denticles and/or thorns dorsally; eyes relatively small (fig. 54) (except in *Urobatis*); Eastern Pacific and Western Atlantic ....
    .... **Urotrygonidae** (16 species; fig. 54, p. 656)

22. Tail without ridge-like lateral skin folds; disc oval to circular (fig. 55) or rhombic (fig. 56); tail typically long, often whip-like (fig. 55); species mostly plain coloured (fig. 56); cosmopolitan ....
    .... **Dasyatidae** (89 species; figs 55, 56, p. 522)

    Anterior tail with ridge-like lateral skin folds (fig. 57); disc oval to circular (fig. 57); tail typically short (except in *Plesiotrygon*); species mostly with rich colour patterns (fig. 57); Central and South America, largely in freshwater ....
    .... **Potamotrygonidae** (34 species; fig. 57, p. 619)

fig. 49

fig. 50

fig. 51

fig. 52

fig. 53

fig. 54

fig. 55

fig. 56

fig. 57

23. Tail filamentous, shorter than disc width and lacking dorsal fins (fig. 61); no thorns or denticles on body (apart from alar thorn patches in adult males); cosmopolitan; Indo–West Pacific and Western Central Atlantic .... **Anacanthobatidae** (13 species; fig. 61, p. 494)

    Tail slender (not filamentous) with 0–2 dorsal fins, when lacking dorsal fins tail length much longer than disc width; thorns and/or denticles usually present somewhere on body 24

24. Rostral cartilage absent or flexible and delicate over most or all of its length (assessed by gently bending snout, fig. 65); rostral base barely extending forward of leading margins of nasal capsules (fig. 65) (except in *Notoraja* and *Brochiraja*); anteriormost part of pectoral-fin skeleton abutting or nearly abutting tip of snout (fig. 65) (not separated from snout tip by wide semi-translucent area; backlighting makes these skeletal structures more visible); ventral terminal clasper cartilage spoon-shaped (fig. 67), without a sharp lateral edge and not forming a shield; cosmopolitan .... **Arhynchobatidae** (104 species; fig. 62, p. 364)

    Rostral cartilage moderately slender to stiff and stout from its base to tip of snout (fig. 66) (except *Breviraja*, *Fenestraja* and *Gurgesiella*); rostral base extending anterior to or forward of leading edges of nasal capsule (fig. 66); anteriormost part of pectoral-fin skeleton separated from tip of snout by semi-translucent area (fig. 66) (except *Breviraja*, *Fenestraja* and *Gurgesiella*); ventral terminal clasper cartilage variably shaped, but with sharp lateral edge forming component shield (fig. 68) 25

25. Pelvic fin single-lobed (much wider than its base width, fig. 70) or very deeply incised with 2 lobes (anterior lobe slender and similar in length to and separated from posterior lobe at its base, fig. 71); Atlantic, South-East Pacific and Indian Ocean .... **Gurgesiellidae** (19 species; fig. 63, p. 473)

    Pelvic fin with 2 lobes, weakly to deeply incised (fig. 69); anterior lobe narrow to rather broad, but generally shorter than posterior lobe (fig. 69); cosmopolitan .... **Rajidae** (154 species; fig. 64, p. 204)

fig. 58

fig. 59

fig. 60

oronasal region

fig. 61

fig. 62

fig. 63

fig. 64

pectoral-fin skeleton

rostral cartilage

ventral marginal cartilage

shield

fig. 65

fig. 66

skeleton of head

fig. 67

fig. 68

claspers

single lobe

fin weakly incised

fig. 69

fig. 70

fig. 71

two lobes

pelvic fins (ventral view)

8

SAWFISHES

Family Pristidae

P.R. Last, W.T. White & G.J.P. Naylor

Sawfishes are amongst the largest of all rays (reaching up to 7 m TL). Their snout is greatly extended to form a hard, flattened blade armed along each edge with a row of sharp, tooth-like denticles – hence the common name 'sawfishes'. The shape of the rostrum and the number, size and position of these rostral teeth differ between species. A shark group, the sawsharks (Pristiophoridae), resemble sawfishes in having a highly modified blade-like snout edged with rostral teeth, but have barbels on the snout and their gills located on the side of the head rather than its undersurface. Unlike other ray groups, the pectoral fins of sawfishes are not fused to the body to form an obvious disc. A sawfish's body is strong, elongate and more or less subcylindrical with a slightly flattened head projecting well forward of the pectoral fins. Eyes are positioned near the sides of the head. Nostrils lie posterior to the toothed part of the rostrum and the mouth is broad and transverse. The two dorsal fins are similar in shape and rather tall, with the first dorsal fin located fully or partly above the pelvic fins. Caudal fin is well developed and its ventral lobe is variably extended depending on the species. All species are plain coloured varying from yellowish, brownish, greyish or greenish above. The family includes 2 genera and 5 valid species. Sawfishes once occurred worldwide in warm temperate to tropical rivers and inshore continental waters, but their abundance and distribution globally has declined dramatically over the last century. Some species are now regionally extinct and all are considered endangered. Sawfishes are largely benthic, resting on or feeding near the bottom. Their highly modified rostrum is used to stun prey such as invertebrates and small fishes. All species are viviparous (aplacental). Sawfishes are particularly vulnerable to overfishing as they are easily entangled in fish nets. Probably once used widely for their meat, their large fins occasionally appear illegally in shark-fin markets.

KEY TO PRISTID GENERA

1. Rostral teeth flattened, blade-like and triangular, and not extending onto basal quarter of saw (fig. 1); nostrils long, narrow and diagonal (fig. 1); lower lobe of caudal fin relatively large, more than half length of upper lobe (fig. 3); Indo–West Pacific ....*Anoxypristis* **(1 species; fig. 3, p. 60)**

2. Rostral teeth moderately flattened, elongated and peg or awl-like, and extending onto basal quarter of saw (almost to base) (fig. 2); nostrils short, broad and transverse (fig. 2); lower lobe of caudal fin small, less than half length of upper lobe (fig. 4); cosmopolitan .... ***Pristis*** **(4 species; fig. 4; pp. 61–64)**

undersurface of head

fig. 1

fig. 2

fig. 3

fig. 4

NARROW SAWFISH

8.1

Anoxypristis cuspidata (Latham, 1794)

EN

IDENTIFICATION. Small to medium-sized sawfish with rostrum lacking rostral teeth on its basal quarter, largely smooth skin, tall narrow-based pectoral fins with pointed apices, and a long lower lobe on the caudal fin. Body subcylindrical, barely depressed anteriorly. Rostrum long and slender, barely tapering, length ~31% TL. Rostral teeth 16–26 (usually 20–25), more widely separated and shortest basally; blade-like, flattened and broadly triangular, becoming curved in adults; posterior edge of teeth sharp, not grooved, with a small barb in young. Nostrils narrow, with groove connecting incurrent aperture to side of head; nasal flaps small. Denticles restricted to rostrum, head, and anterior margin of fins, scattered and widely spaced elsewhere. First dorsal-fin origin well posterior to origin of pelvic fins. Caudal fin with deeply concave posterior margin, small fleshy notch on mid-outer margin of upper lobe; lower lobe enlarged, more than half length of upper lobe; caudal-fin base with 2 lateral keels, a short ventral keel located below a longer and thicker median keel.

COLOUR. Dorsal side uniformly slate grey, often with bluish tinge; posterior parts of fins often paler; rostral teeth white. Ventral side whitish.

SIZE. Unconfirmed, at least 350 cm TL but possibly to 470 cm TL. Males mature at ~200 cm TL and females at 225 cm TL; birth size unclear, reported to be between 43 and 70 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; widespread, Red Sea to eastern Australia and Japan. Primarily coastal in shallow embayments to at least 40 m depth; also ventures into estuaries. Most fecund sawfish; reported to reach sexual maturity at 2–3 years. Females have litters of ~12 pups born in coastal and estuarine habitats. Probably a more active swimmer than other sawfishes. Feeds on fishes and small benthic invertebrates such as prawns. Undergone range constriction but possibly less threatened than other sawfishes.

SIMILAR SPECIES. Distinguishable from all other sawfishes by a toothless basal portion of the rostrum, small pectoral fins, and pronounced lower lobe on the caudal fin.

DWARF SAWFISH

8.2

Pristis clavata Garman, 1906

EN

IDENTIFICATION. Small, heavy-bodied sawfish with rough denticles covering entire body, short rostrum with rostral teeth extending forward from its base, first dorsal fin usually slightly behind pelvic-fin origin, pectoral fins low and broad based with rounded apices, and no obvious lower lobe on the caudal fin. Body depressed, more so anteriorly. Rostrum broad and stout, converging slightly to its tip, length 20–25% TL. Rostral teeth 18–24, uniformly separated and of similar size and shape; teeth peg-like, flattened slightly and elongate, young with shallow posterior groove but without a barb; groove often incomplete, not extending to base of tooth. Broad nostrils with large nasal flaps, without groove connecting nostrils to side of head. Squamation pattern uniform in young and adults. First dorsal-fin origin over or slightly behind origin of pelvic fins. Caudal fin with posterior margin almost straight, no fleshy projection on upper lobe; caudal base lacking a short keel below large median keel.

COLOUR. Dorsal side usually greenish grey to greenish brown, fins often paler; rostral teeth white. Ventral side white.

SIZE. Reaches at least 310 cm TL, possibly larger. Males mature at ~260 cm TL, females possibly slightly larger; born at 65 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; India (Bay of Bengal) to eastern Australia, isolated record from Réunion. Demersal in shallow coastal inshore habitats on tidal flats, and in mangrove swamps and embayments; ventures well upstream in rivers, possibly into freshwater. Pupping is thought to occur during the tropical wet season; in Australia from November to March. Occurrence inshore makes it particularly vulnerable to capture in inshore gillnet fisheries.

SIMILAR SPECIES. Similar to the larger Smalltooth Sawfish (8.3) with which it appears to have been confused in the past. The Dwarf Sawfish has a shorter rostrum and fewer rostral teeth, and a more posteriorly positioned first dorsal fin. The ranges of these species do not appear to overlap.

SMALLTOOTH SAWFISH

8.3

Pristis pectinata Latham, 1794

CR

IDENTIFICATION. Large heavy-bodied sawfish with rough denticles covering entire body, long rostrum with rostral teeth not noticeably closer to each other at its tip than at its base, origin of first dorsal fin usually over pelvic-fin origin, pectoral fins low and broad based with angular apices, and no obvious lower lobe on the caudal fin. Body depressed, more so anteriorly. Rostrum narrow, not converging to its tip, length 21–30% TL. Rostral teeth 20–30, posterior-most tooth located near base of rostrum, teeth equally spaced or marginally closer near its tip; teeth peg-like, flattened and elongate, with posterior groove in adults but smooth without barb in young; groove reaching base of each tooth. Broad nostrils with large nasal flaps, without groove connecting nostrils to side of head. Squamation pattern uniform over body in young and adults. Origin of first dorsal fin over or sometimes slightly posterior to pelvic-fin origins. Caudal fin with posterior margin straight, no lower lobe or fleshy projection on upper lobe; caudal base with a large median lateral keel.

COLOUR. Dorsal side grey to bluish grey; rostral teeth white. Ventral side white.

SIZE. Reaches at least 554 cm TL, reports to 760 cm TL are likely exaggerations. Maturity size unclear, male of 371 cm TL and female of 415 cm TL were sexually mature; born at ~60 cm TL.

HABITAT AND BIOLOGY. Atlantic and South-West Indian Oceans; once widespread. Historically, occurred in warm coastal seas, often nearshore to a depth of least 88 m; typically shallower than 10 m and showing a degree of site fidelity. Populations now fragmented, species considered to be extinct through most of its original range. Females have litters of around 15–20 pups. Feeds on crabs and other benthic invertebrates.

SIMILAR SPECIES. Reports of this sawfish in the Western Central Pacific appear to be misidentifications of the Dwarf (8.2) and the Green Sawfishes (8.5). Its former occurrence in the Indian Ocean is unclear but it appears to be extinct off eastern Africa.

LARGETOOTH SAWFISH

8.4

Pristis pristis (Linnaeus, 1758)

CR

IDENTIFICATION. Very large, heavy-bodied sawfish with rough denticles covering entire body, broad rostrum with rostral teeth not noticeably closer to each other at its tip than at its base, first dorsal fin originating well forward of pelvic fin, pectoral fins tall and broad based with angular apices, and caudal fin with a short lower lobe. Body robust, somewhat depressed anteriorly. Rostrum broad throughout its length but converging distally, length ~27% TL. Rostral teeth 14–24, equally spaced, posterior-most tooth located near base of rostrum; teeth peg-like, flattened and elongate, with variable posterior groove at all ages but without a barb in young. Broad nostrils with large nasal flaps, without groove connecting nostrils to side of head. Denticle pattern uniform in young and adults. Origin of first dorsal fin well forward of pelvic fins. Caudal fin with posterior margin straight to slightly concave with an obvious lower lobe, no fleshy projection on upper lobe; no short caudal keel below large median keel at caudal base.

COLOUR. Dorsal side yellowish to greyish, fins distinctly yellowish; rostral teeth white. Ventral side white.

SIZE. Reaches at least 656 cm TL, but possibly over 700 cm TL. Maturity size ~280–300 cm TL; born at 72–90 cm TL.

HABITAT AND BIOLOGY. Historically, globally widespread in tropical seas; now greatly restricted due to likely extinction through much of its range. Occurs in coastal habitats, estuaries and freshwater, including rivers and waterholes, to at least 25 m depth. Young spend much of their early life in rivers up to 400 km from the sea. Reaches sexual maturity at 8–10 years and females have litters of around 1–13 pups. Feeds on fishes, crustaceans and molluscs.

SIMILAR SPECIES. Several scientific names have been used for four subpopulations of the Largetooth Sawfish. Distributional information is uncertain due to confusion between this species and other large sawfishes. Only sawfish with the dorsal fin positioned well forward of the pelvic fins, and only member of the genus with a small ventral lobe on the caudal fin.

GREEN SAWFISH

8.5

Pristis zijsron Bleeker, 1851

CR

IDENTIFICATION. Very large heavy-bodied sawfish with rough denticles covering entire body, long rostrum with rostral teeth noticeably closer to each other at its tip than at its base, first dorsal fin completely behind pelvic-fin origin, pectoral fins low and broad based with angular apices, and no obvious lower lobe on the caudal fin. Body depressed, more so anteriorly. Rostrum rather narrow, not converging to its tip, length 23–33% TL. Rostral teeth 23–37 (usually 24–31), posterior-most tooth located near base of rostrum; teeth peg or awl-like, flattened and elongate, with variable posterior groove at all ages but without barb in young. Broad nostrils with large nasal flaps, without groove connecting nostrils to side of head. Squamation pattern not uniform, with young having slightly enlarged denticles on dorsal mid-line. First dorsal-fin origin usually above mid-base of pelvic fins. Caudal fin with posterior margin convex in young and straight in adults, no lower lobe or fleshy projection on upper lobe; no short caudal keel below large median keel at caudal base.

COLOUR. Dorsal side uniformly olive to greenish brown; rostral teeth white. Ventral side white.

SIZE. Possibly to 730 cm TL, but specimens exceeding 600 cm TL are rare. Maturity size unclear, possibly near 430 cm TL; born at ~80 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; South Africa to eastern Australia. Demersal on both insular and continental shelves, but now thought to be extinct through much of its original range. Lives mainly inshore to depths exceeding 70 m; possibly more tolerant than other sawfishes of cool water. Reaches maturity after 9 years. Females have litters of ~12 pups with newborns using nearshore habitats and estuaries as nurseries.

SIMILAR SPECIES. Similar to another large sawfish, the Smalltooth Sawfish (8.3), with which it may have been confused in the Western Indian Ocean. Anterior rostral teeth situated closer together than those near the base of the rostrum in both species (although more so in the Green Sawfish), but they also differ in the relative position of the first dorsal fin (more posterior in the Green Sawfish).

9

WEDGEFISHES

Family Rhinidae

P.R. Last, W.T. White & B. Séret

Wedgefishes are medium to large, shark-like rays (0.7–3.1 m TL as adults and weighing at least 227 kg) with a variably depressed trunk, weakly formed disc, and a head either thickened and broadly domed, or flattened wedge-shaped or rounded. Pectoral fins are triangular and join the body behind eye level. The nostrils are long and narrow, and usually lie oblique to a small horizontal mouth with rounded to oval teeth that lack distinct cusps. The anterior nasal flaps are poorly developed and do not form a nasal curtain. The spiracles are large with 0–3 skin folds along their hind margin. A robust tail is slightly longer than the disc, and has two upright dorsal fins (the first above the pelvic fins), and a well-developed bilobed caudal fin with a strongly concave posterior margin. Its pelvic fins are moderately sized, angular and are not divided into two lobes. The skin is covered with minute denticles and there is a variably developed series of thorns along the dorsal mid-line, and usually 2–3 short series on each shoulder. Dorsal surface mainly yellowish to greyish brown and white ventrally. Often with rows of white spots or ocelli, and often a black blotch on each pectoral fin (pectoral marking) that is variably surrounded by white spots (marking generally most obvious in young). The undersurface of the snout can have a blackish marking. The family now includes 10 valid species from 3 genera: *Rhina*, *Rhynchobatus* and *Rhynchorhina*. Historically, the genera *Rhina* and *Rhynchobatus* have been either placed together in the Rhinidae or assigned to separate families. However, recent molecular research has provided evidence that they belong to the same family (Rhinidae), including the newly named genus *Rhynchorhina* which is based on an unusual Eastern Atlantic species having a wedge-shaped body with a rounded snout. Wedgefishes are mostly found in warm temperate to tropical inshore continental seas, and rarely occur deeper than 400 m. They are usually marine, but an individual of *Rhina* was caught in freshwater in New Caledonia. Wedgefishes primarily have an Indo–Pacific distribution, with only two species occurring in the Atlantic Ocean. They are strong swimmers, and bottom-dwellers that rest rather than burrow on muddy or sandy bottoms. All species are viviparous (aplacental). They feed on benthic invertebrates and small bottom-dwelling fishes. Most wedgefishes are highly sought after for their meat, and the high value of their large fins on international shark-fin markets has led to overfishing and population declines in some areas. Caught mainly as bycatch by trawls, gill and tangle nets, and longlines. Popular as exhibits in public aquaria around the world.

KEY TO RHINID GENERA

1. Head angular and wedge-shaped (fig. 2); back with thorns but without ridges of strongly developed thorny tubercles (fig. 2); 2 spiracular folds (fig. 1); Eastern Atlantic and Indo–West Pacific .... ***Rhynchobatus*** **(8 species; fig. 2, pp. 68–75)**

   Head broadly rounded (fig. 4) or blunt (fig. 6); mid-line of disc and tail with ridges of large thorns (fig. 4); 0–2 spiracular folds 2

2. Snout broadly rounded (fig. 4); upper jaw with 3 deep concavities (fig. 3); no spiracular folds; Indo–West Pacific .... ***Rhina*** **(1 species; fig. 4, p. 67)**

   Snout blunt (fig. 6); upper jaw with one deep concavity (fig. 5); 1–2 spiracular folds; Eastern Atlantic .... ***Rhynchorhina*** **(1 species; fig. 6, p. 76)**

fig. 1

fig. 2

fig. 3

fig. 4

fig. 5

oronasal region

fig. 6

SHARK RAY

9.1

Rhina ancylostoma Bloch & Schneider, 1801

VU

IDENTIFICATION. Large, heavy-bodied ray with a shark-like body, head broadly rounded and distinctly demarcated from pectoral fins, no spiracular folds, ridges of large thorns on back, and dark bands between eyes. Body greatly thickened above abdomen; tail much longer than disc and broad based. Snout broadly rounded; deep notch on anterior profile of body at junction of head and pectoral fins. Spiracles large, without folds of any kind. Eyes rather large. Nostrils elongate and almost transverse; width about equal to internasal space. Lower jaw strongly trilobed, lobes recessing into concavities in upper jaw. Dorsal fins very tall and falcate, first larger than second; first dorsal-fin origin over or slightly forward of pelvic-fin origin. Caudal fin lunate, very large, with a distinct lower lobe only slightly shorter than upper lobe; its posterior margin deeply concave. Skin uniformly covered with minute denticles. A series of prominent ridges on mid-line of back, above and forward of eye, and on shoulders; ridges with numerous large thorns; thorns broad based, compressed, triangular, with very sharp tips.

COLOUR. Upper surface bluish grey to brownish, covered with large white spots and lines; large white-edged, black pectoral marking in young, often absent in adults; dark transverse bands between eyes and spiracles; margins of pectoral fins and snout paler; dorsal and caudal fins bluish grey to brownish, often with white spots; large adults often brownish with only faint spots and lines. Ventral surfaces pale.

SIZE. Attains 270 cm TL. Males mature at 150–175 cm TL, females at ~180 cm TL, size at birth 46–48 cm TL.

HABITAT AND BIOLOGY. Widespread in Indo–West Pacific; South Africa to New Caledonia, and north to Japan. Demersal, coastal and offshore reefs to depths of at least 70 m. Produces litters of 2–11 pups. Feeds on bony fish (such as croakers), crabs, prawns, bivalves and cephalopods.

SIMILAR SPECIES. Distinctive ray that has been surprisingly confused with angelsharks (*Squatina*). It differs from the False Shark Ray (9.10) in having a broader head, trilobed mouth and more prominent thorny ridges.

BOTTLENOSE WEDGEFISH

9.2

Rhynchobatus australiae Whitley, 1939

VU

IDENTIFICATION. Large wedgefish with a bottle-shaped snout, small thorns on back and around eyes but absent from snout, high vertebral count, mainly pale coloration dorsally with a sparse coverage of white spots, and a pectoral marking surrounded by a distinctive pattern of white spots (or entirely dark with an indistinct marking in large individuals). Disc wedge-shaped with centre raised evenly; anterior margin indented slightly near tip and strongly convex beside eye. Snout narrowly angular, length 3.4–4.4 times orbit length. Spiracle with 2 prominent, similar-sized skin folds. Thorns small, short, blunt; present along mid-line, on shoulder (in 2–3 short rows), beside spiracle, and around upper margin of eye. Dorsal fins distinctly falcate in adults; first dorsal fin much larger than second; first dorsal-fin origin slightly behind pelvic-fin origin. Pectoral-fin apices angular. Caudal fin deeply concave. Total free vertebral centra 144–164.

COLOUR. Dorsal surface variably pale grey to yellowish brown with a sparse coverage of white spots and a well-defined black pectoral marking in juveniles and subadults, no additional dark spots and markings around eye and spiracle; pectoral marking about subequal to eye when present, surrounded by diagonal row of 3 white spots above and 2 similar spots below, marking often indistinct or absent in adults; pectoral-fin hind margin with multiple rows of small white spots; trunk with 2–4 rows of white spots, commencing just forward of pectoral-fin insertion but not reaching second dorsal fin in young; large adults almost entirely blackish, white spots and pectoral marking usually not discernible. Ventral surface almost uniformly whitish, often with small dark markings near snout tip.

SIZE. Females to ~300 cm TL, males smaller and maturing at ~124 cm TL; birth size unknown.

HABITAT AND BIOLOGY. Indo–West Pacific; Mozambique to eastern Australia. Benthic, coastal inshore to a depth of 60 m or more. Diet consists mainly of bottom-dwelling fishes, crustaceans, and molluscs.

SIMILAR SPECIES. Combination of a bottle-shaped snout, and line of three white spots over the pectoral marking (usually 2 spots below), distinguishes this wedgefish from its relatives. Australian populations have fewer vertebrae than elsewhere.

ROUGHNOSE WEDGEFISH

9.3

Rhynchobatus compagnoi Last & Kyne, 2016

VU

IDENTIFICATION. Small wedgefish with a long bottlenose snout armed with 2 rows of large thorns, low vertebral count, dark dorsally with large white spots in young, and lacking a dark pectoral marking. Disc narrowly wedge-shaped, anterior margin indented slightly near tip and strongly concave behind eye. Snout elongate and narrowly pointed, length 4.8–6.4 times orbit length. Spiracle with 2 skin folds of similar size. Thorns well developed along dorsal mid-line, rudimentary and much less evident on shoulder; absent from spiracle and upper margin of eye, and in 2 rows on rostral ridges of snout. Dorsal fins bluntly rounded in adults; first dorsal fin 1.1–1.4 times taller than second; first dorsal-fin origin well behind origin of pelvic fin. Pectoral-fin short, apices narrowly rounded. Caudal fin concave. Total free vertebral centra 99–106.

COLOUR. Dorsal surface dark greenish brown with prominent pale margin in adults and no pectoral marking; young white-spotted. White spots large (subequal to pupil) extending from central snout to before second dorsal fin; ~4 between eyes and ~4 between dorsal fins; no distinct rows of white spots along tail. Ventral surface uniformly white, undersurface of snout without dark markings.

SIZE. Attains at least 82 cm TL, males maturing from ~71 cm TL, born at ~14 cm TL.

HABITAT AND BIOLOGY. Indo–Malay Archipelago. Benthic, poorly known with restricted distribution, probably coastal. Specimens also observed in Indonesian fish markets (Java) likely to have been caught further north. Uncommon in recent landings.

SIMILAR SPECIES. Smallest member of the family, it is also the only wedgefish species to have large thorns on the snout.

WHITESPOTTED WEDGEFISH

9.4

Rhynchobatus djiddensis (Forsskål, 1775)

VU

IDENTIFICATION. Large wedgefish with a bottle-shaped snout, small thorns on back and around eyes but absent from snout, high vertebral count, dense pattern of white spots and rings extending forward of pectoral markings on mid-disc, pectoral marking present in young, and distinctive mask-like markings between orbits. Disc wedge-shaped with centre raised evenly; anterior margin double concave, indented slightly near tip and weakly convex beside eye. Snout rather angular, length 3.6–4.7 times orbit length. Spiracle with 2 short, similar-sized skin folds. Thorns prominent, in a continuous row along mid-line of body; paired rows on each shoulder, in a long broken inner row and a very short outer row; beside spiracle, and around front and upper margin of eye. Dorsal fins falcate in large adults; first dorsal fin slightly larger than second; first dorsal-fin origin behind pelvic-fin origin. Pectoral-fin apices bluntly angular. Caudal fin deeply concave. Total free vertebral centra 174–183.

COLOUR. Dorsal surface pale brownish to dark greyish to greenish brown, covered with variable pattern of white spots and rings that extend well forward on body; white markings in rows in young, largest individuals marbled with markings covering most of upper surface; obvious dark mask-like interorbital bars with white margins in young, bars persisting but narrowing in adults; snout edges whitish, much paler than mid-snout; black pectoral marking large and surrounded by white spots in juveniles, marking consisting of a dusky ring or absent in adults. Dorsal fins paler, usually plain yellowish. Undersurface white.

SIZE. Females to 310 cm TL, but typically smaller to ~175 cm TL, males maturing at ~150 cm TL; born at ~60 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; South Africa to Oman. Benthic, coastal and continental shelf to 70 m depths, typically shallower than 35 m. Slow-growing and producing ~4 pups in each litter. Diet consists mainly of crabs, bivalve molluscs and bony fishes.

SIMILAR SPECIES. Co-occurs in parts of its range with the Bottlenose (9.2) and Smoothnose Wedgefishes (9.6). It can be distinguished from these rays by prominent black bars between the orbits, ring-like colour pattern of adults, and a particularly high vertebral count.

TAIWANESE WEDGEFISH

9.5

Rhynchobatus immaculatus Last, Ho & Chen, 2013

NE

IDENTIFICATION. Medium-sized wedgefish with a broad snout, small thorns of varying sizes on back and around eyes but absent from snout, very high vertebral count, and a greenish brown coloration dorsally, lacking a pectoral marking, and having a distinctive pattern of white spots coalescing to form a white stripe on tail. Disc wedge-shaped, anterior margin slightly convex beside orbit, otherwise almost straight. Snout broadly angular, length 4–4.5 times orbit length. Spiracle with 2 skin folds, outer fold slightly taller than inner fold. Thorns small, short, blunt; present along mid-line, on shoulder (in 2 short discontinuous rows), beside spiracle, and around upper margin of eye. Dorsal fins bluntly pointed in adults; first dorsal fin 1.1–1.3 times taller than second; first dorsal-fin origin just forward of mid-base of pelvic fin. Pectoral-fin apices broadly angular. Caudal fin deeply concave. Total free vertebral centra 165–170.

COLOUR. Dorsal surface greenish brown, yellowish beside rostral cartilage on snout and along hind margins of pectoral and pelvic fins; no pectoral marking, instead with 1–3 small, fuzzy-edged white spots; a few similar white spots near pectoral-fin insertion, near bases of dorsal fins and single spot over pelvic-fin insertion; row of small white spots on flank originating over origin of pelvic fin, then coalescing beneath first dorsal fin to form a narrow white stripe; stripe extending along dorsolateral surface of each side of tail to anterior part of caudal peduncle; dorsal and caudal fins yellowish brown, paler than body; orbit white with a broad black bar on upper surface; suborbit pale; interorbit with a few white spots on each side near orbit and with or without a dark medium blotch. Ventral surface white; anterior half of snout either side of rostral shaft with black semicircular patch.

SIZE. Attains at least 99 cm TL, but probably larger to between 120–150 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; off Taiwan. Benthic, recently discovered and not well known, but apparently lives in shallow water on the continental shelf. Diet probably consists of bottom-dwelling crustaceans and fishes.

SIMILAR SPECIES. Similar to the Roughnose Wedgefish (9.3), another small species from nearby parts of the North-West Pacific, but the Taiwanese Wedgefish lacks spines on its snout (*vs.* having well-developed spines on a much narrower snout). Both species lack a pectoral marking, which exists in all other wedgefishes at lengths less than 1 m.

SMOOTHNOSE WEDGEFISH

9.6

Rhynchobatus laevis (Bloch & Schneider, 1801)

VU

IDENTIFICATION. A large wedgefish with a broad snout, small rounded thorns on back and around eyes but absent from snout, low vertebral count, prominent pectoral marking usually surrounded by 4–5 white spots, lacking dark interorbital markings, ventral snout tip usually black, and upper body with multiple rows of white spots posterior to level of pectoral marking. Disc obtusely wedge-shaped, anterior margin slightly convex beside orbit, otherwise almost straight. Snout short, length 3.2–4.4 times orbit length; broad and bluntly angular in young, narrower in adults. Spiracle with 2 short skin folds, outer fold slightly taller than inner fold. Thorns small, blunt; present along dorsal mid-line, on shoulder (in a discontinuous mid-lateral row), beside spiracle, and around upper margin of eye. Dorsal fins weakly falcate, tips narrowly pointed in adults; first dorsal fin 1.2–1.5 times taller than second; first dorsal-fin origin over or slightly forward of origin of pelvic fin. Pectoral-fin apices angular. Caudal fin short, very deeply concave. Total free vertebral centra 135–144.

COLOUR. Dorsal surface greyish in young, sometimes brownish in adults, with 4–5 rows of white spots along each side beneath first dorsal fin; predorsal spots not reaching forward of mid-line between pectoral markings, spots coalesced to form white stripes on posterior tail; sides of snout pale or pinkish; pectoral marking large, often ocellated, closely surrounded by 4–7 small white spots; orbital membrane often with curved black markings; preorbit with oblique whitish bar. Ventral surface uniformly white; a large black blotch usually covering anterior half of snout.

SIZE. Uncertain (due to misidentification), possibly well in excess of 200 cm TL and up to 240 kg; males mature at ~130 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; Oman to Japan, primarily in Indian Ocean. Benthic, mainly near the coast in shallow bays and off river mouths. Poorly known, but probably feeds on bottom-dwelling crustaceans and fishes.

SIMILAR SPECIES. Closely related to the Eyebrow Wedgefish (9.8), but has a more westerly distribution in the Indo–Pacific. These species differ genetically and the Smoothnose Wedgefish has a more densely spotted colour pattern.

AFRICAN WEDGEFISH

9.7

Rhynchobatus luebberti Ehrenbaum, 1915

EN

IDENTIFICATION. Large wedgefish with a bottle-shaped snout, prominent rows of thorns on rostral ridges, posteriorly positioned first dorsal fin, high vertebral count, dense pattern of white spots, and pectoral marking weak or absent. Disc wedge-shaped with its centre raised; anterior margin indented slightly near tip and distinctly concave beside eye. Snout broadly angular, elongate, length 3.8–5.4 times orbit length. Spiracle with 2 prominent, similar-sized skin folds. Thorns small, short, present along mid-line and extending back to second dorsal fin; parallel rows of snout thorns along edge of rostral cartilage; 2 short thorn rows on each shoulder, innermost row longer than orbit, outermost row much shorter; similar thorns beside spiracle and around upper margin of eye. Dorsal fins weakly falcate; first dorsal fin slightly larger than second; first dorsal-fin origin well behind pelvic-fin origin. Pectoral-fin apices angular. Caudal fin deeply concave. Total free vertebral centra 172–176.

COLOUR. Dorsal surface variably pale greyish brown to greenish brown, densely covered with numerous, often dark-edged, white spots in irregular rows over most of body behind spiracles; black pectoral marking small in young, often accompanied medially by a pair of large black blotches on shoulders; pectoral marking usually absent in adults; faint dark interorbital bars in young, upper membrane of orbit dark, fins similar to body colour. Ventral surface almost uniformly whitish, usually with broad transverse black blotch on snout.

SIZE. To ~300 cm TL, maturity size unknown but born at 79–85 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic; Congo to Mauritania. Benthic, coastal marine and inshore to at least 35 m depth. Diet probably consists mainly of small bony fish and invertebrates. Produces litters of 2–5 pups.

SIMILAR SPECIES. Closely related to the Whitespotted Wedgefish (9.4), which it resembles in appearance and colour, and both species have dark markings between the orbits in juveniles. However, the African Wedgefish's paired rows of rostral thorns on the snout are unique within the genus.

EYEBROW WEDGEFISH 9.8

Rhynchobatus palpebratus Compagno & Last, 2008

NT

IDENTIFICATION. A large wedgefish with a broad snout, small variable-sized thorns on back and around eyes but absent from snout, low vertebral count, prominent pectoral marking usually surrounded by 4 white spots, dark eyebrow markings on orbital membrane, and white spots absent from the posterior tail of adults. Disc obtusely wedge-shaped, anterior margin slightly convex beside orbit, otherwise almost straight. Snout broadly angular, long, length 3.6–4.1 times interorbital width. Spiracle with 2 skin folds, outer fold slightly taller than inner fold. Thorns very small, partly embedded, pearl-shaped; along mid-line, in a short mid-lateral row (occasionally with a single thorn more laterally) on each shoulder, beside spiracle, and along upper margin of eye. Dorsal fins narrowly pointed in adults; first dorsal fin 1.3–1.4 times taller than second; first dorsal-fin origin over origin of pelvic fin. Pectoral-fin apices angular. Caudal fin short, very deeply concave. Total free vertebral centra 130–147.

COLOUR. Dorsal surface dark yellowish to greyish; pectoral marking large, sharp edged, usually surrounded by 4 (occasionally 3) equally spaced white spots; orbital membrane with 2 curved black markings; spiracle, and front and back of orbit white; preorbit with oblique white bar, directed medially; sometimes with black spot near spiracle; with 2–4 rows of white spots commencing just forward of pectoral-fin insertion and sometime reaching free tip of second dorsal fin; tail beyond pelvic fins without spots but often with white stripe in adults. Ventral surface uniformly white; sometimes with black blotches on snout.

SIZE. To at least 262 cm TL; males sexually mature at 103 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; northern Australia and Papua New Guinea. Benthic, poorly known, lives in shallow water on the continental shelf. Probably feeds on bottom-dwelling crustaceans and fishes.

SIMILAR SPECIES. Very similar to the Smoothnose Wedgefish (9.6), which is more widespread in the Indo–West Pacific, but differs in its DNA, and has a more densely spotted upper surface. It is also similar to the Broadnose Wedgefish (9.9) but has a slightly narrower snout, higher vertebral count, slightly smaller mid-dorsal thorns, and the posterior tail lacks rows of white spots in adults.

BROADNOSE WEDGEFISH

9.9

Rhynchobatus springeri Compagno & Last, 2010

VU

IDENTIFICATION. A robust, large wedgefish with a broad snout, prominent rows of small thorns on back and around eyes but absent from snout, low vertebral count, pectoral marking surrounded by 3–4 white spots, usually with dark eyebrow-like markings on orbit, and up to 3 rows of white spots along tail in adults. Disc broadly wedge-shaped, anterior margin slightly convex beside orbit, otherwise almost straight. Snout bluntly angular, short, length 3.3–3.6 times orbit length. Spiracle with 2 skin folds, outer fold slightly taller than inner fold. Thorns blunt, most obvious in young; present along mid-line, and a few on shoulder (in 2 short discontinuous rows), beside spiracle, and around upper margin of eye. Dorsal fins bluntly pointed in adults; first dorsal fin 1.3–1.5 times taller than second; first dorsal-fin origin over origin of pelvic fin. Pectoral-fin apices broadly angular. Caudal fin short, deeply concave. Total free vertebral centra 113–126.

COLOUR. Dorsal surface pale greyish green to greyish brown; pectoral marking small to medium-sized and present in adults, surrounded by 3–4 white spots (outermost pair closer together than inner pair); orbital membrane with two curved black markings, anterior marking abutted anteriorly by white blotch, posterior marking larger; preorbit with narrow oblique white bar, directed medially; sometimes with black spot near spiracle; adults with rows of dark-edged white spots over most of trunk and tail; spots in 3–4 rows beneath first dorsal fin and in 3 closely spaced rows to caudal-fin base (partly coalescing to form a pale stripe). Ventral surface white; no black patches on snout.

SIZE. Attaining at least 213 cm TL; males mature at around 115 cm TL.

HABITAT AND BIOLOGY. Indo–Malay Archipelago. Benthic, poorly known. Most likely lives in turbid brackish coastal and estuarine waters, rather than the open sea. Diet unknown, but probably similar to other wedgefishes.

SIMILAR SPECIES. Most similar to the Eyebrow Wedgefish (9.8), but has a slightly broader snout, lower vertebral count, slightly larger mid-dorsal thorns, and a more strongly spotted tail in adults.

FALSE SHARK RAY

9.10

Rhynchorhina mauritaniensis Séret & Naylor, 2016

NE

IDENTIFICATION. Large wedgefish with a thick shark-like body and blunt snout, prominent thorn patches on ridges above eyes and spiracles, on shoulder and along mid-line of back, upper surface covered with very dense pattern of white spots, pectoral marking present only in young, and large black blotch on ventral snout tip. Heavy-bodied, trunk thick; head somewhat flattened, snout tip quadrangular to very broadly rounded (rather than long and pointed). Large spiracles with 1–2 folds. Nostrils very broad, oblique, inner part curved, their length much greater than internasal space. Small thorns at snout tip and on rostral ridges; row of thorns above orbit and spiracle, 1–2 rows on shoulders and on mid-line on back and between dorsal fins. Dorsal fins large and falcate; first dorsal fin over pelvic-fin insertion; interdorsal space long, about twice length of first dorsal-fin base. Pelvic fins small, triangular.

COLOUR. Dorsal surface greyish to greenish brown, covered with numerous white, dark-rimmed spots (sometimes with dark centres); spots in irregular rows on trunk and pectoral fins, no white spots on head; dark pectoral marking present in young, usually absent in adults; no distinct dark marking on interorbital space. Ventral surface white, posterior margins of pectoral and pelvic fins greyish; large transverse black blotch or cluster of dark spots on snout tip.

SIZE. Attains at least 224 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic, off Mauritania. Benthic, range probably very restricted, known from a few specimens caught in shallow water on a sandy shoal known as 'Banc d'Arguin'.

SIMILAR SPECIES. Unusual wedgefish with a unique flattened, quadrangular to broadly rounded snout. Its coloration resembles a sympatric *Rhynchobatus* species, the African Wedgefish (9.7) and its general appearance is somewhat similar to the Shark Ray (9.1).

10

GUITARFISHES

Family Rhinobatidae

B. Séret, P.R. Last & G.J.P. Naylor

Guitarfishes, otherwise known as shovelnose rays, are small to large rays (some mature at ~50 cm TL whereas others attain 1.7 m TL). They have a flattened wedge- or shovel-shaped disc with a strongly depressed trunk. The snout is often elongate and its tip varies from narrowly pointed to broadly rounded. Eyes and spiracles vary from medium to large, the latter with 1–2 variably developed folds. Nostrils rather short and very oblique with fewer than 68 lamellae. All species lack a nasal curtain, and the anterior nasal flaps are often broad and joined posteriorly to either close to the inner edge of the nostril or slightly within the interspace between the nostrils. Mouth profile is straight. The skin is usually covered with fine denticles (sometimes partly naked), and small thorns and thornlets are variably developed in a row along dorsal mid-line of body, in small patches near eyes, and on shoulder and snout. Long-based pelvic fins are positioned laterally and posteriorly to the disc. Two upright or tilted dorsal fins are well separated, with the first positioned well to slightly behind rear tips of the pelvic fins. The small caudal fin lacks an obvious ventral lobe. Dorsal coloration varies from plain (usually greyish or brownish) to having a strong pattern of lines, bars, spots and/or blotches. The cranium and rostral cartilage are not usually sharply demarcated at their edges with the snout. The undersurface is usually white but a black blotch is often present on the snout. Until recently, the family Rhinobatidae included the giant guitarfishes (Glaucostegidae) and banjo rays (Trygonorrhinidae) but recent molecular analyses have shown that members of these three groups are distinct from each other. Guitarfishes, as defined herein, are provisionally represented by 3 genera (*Acroteriobatus*, *Rhinobatos* and *Pseudobatos*) and 31 valid species. However, based on mitochondrial DNA sequence comparisons, the amphi-American genus (*Pseudobatos*) is strongly divergent from the other genera and may belong within a separate family. Guitarfishes occur in all warm temperate and tropical oceans, inshore to well offshore on continental and insular shelves and slopes, to depths of at least 400 m. None of the species occurs in freshwater. As bottom-dwellers, they usually rest on, or lie partly concealed within soft mud or sandy sediments, rather than swimming actively in midwater. Viviparous (aplacental) producing litters of up to 16 young. They feed mainly on small benthic invertebrates and fishes. Usually too small to be of major significance to the fin trade, but some species are utilised for their high-quality flesh. Typically caught as bycatch of trawl and set-net fisheries.

KEY TO RHINOBATID GENERA

1. Anterior nasal flaps extending well into internasal space, almost joined at mid-line of snout (fig. 1); Eastern Atlantic and Western Indian Oceans .... ***Acroteriobatus*** **(8 species; fig. 4, pp. 79–86)**

   Anterior nasal flaps not or only slightly extending into internasal space, their posterior edges well separated and falling well short of snout mid-line (figs 2, 3) 2

2. Anterior nasal flaps moderately developed; their posterior edge extending slightly into internasal space, reaching level above innermost corner of nostril (fig. 2); Eastern Atlantic and Indo–West Pacific .... ***Rhinobatos*** **(15 species; fig. 5, pp. 95–109)**

   Anterior nasal flaps short; not or barely extending into internasal space, their posterior edge confined to anterior margins of nostril (fig. 3); amphi-American distribution .... ***Pseudobatos*** **(8 species; fig. 6, pp. 87–94)**

fig. 1

fig. 2

oronasal region

fig. 3

fig. 4

fig. 5

fig. 6

LESSER GUITARFISH

10.1

Acroteriobatus annulatus (Müller & Henle, 1841)

LC

IDENTIFICATION. Large guitarfish with a broad, wedge-shaped disc, short bluntly triangular snout, anterior nasal flaps almost joined at snout mid-line, and a dorsal pattern of numerous small blotches resembling eyespots. Disc rather thick, length ~1.1 times its width; anterior margins slightly convex, outer corner of pectoral fins broadly rounded to angular. Snout angle ~70°; eye large, slightly larger than spiracle; orbit length ~3.4 in preorbital length, ~1.2 in interorbital space. Rostral ridges widely separated with a weak mid-constriction. Spiracle with 2 prominent fleshy folds. Tooth rows in upper jaw 41–45. Nostrils short, oblique, slightly longer than internasal space; anterior nasal flaps greatly developed, their innermost margins extending across most of internasal space. Skin entirely covered in fine denticles; small tubercles around orbits and spiracles; mid-dorsal row of ~35 small tubercles. Tail ~1.6 times longer than disc; large dorsal fins widely spaced, apices narrowly rounded. Pectoral-fin radials 72–74. Total vertebral centra 190–200.

COLOUR. Dorsal surface light brown with a distinctive pattern of numerous dark spots or small ocelli, each consisting of a central dark spot surrounded by a dark-edged pale ring; markings more or less symmetrically arranged. Ventral surface uniformly white.

SIZE. Apparently reaches 140 cm TL, usually much smaller. Males mature at ~59 cm TL and females at 62–65 cm TL, born at ~23 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Oceans; Namibia to Natal (South Africa). Benthic, common in shallow waters to at least 75 m depth. Feeds on small benthic invertebrates and small fishes. Produces litters of 2–10 pups.

SIMILAR SPECIES. Specimens from Natal have a dorsal pattern consisting of brown spots whereas those from the South African Cape Province are ocellated. The Speckled Guitarfish (10.4) also has a pattern of eyespots that are blue-grey with a brownish rim.

BLUNTNOSE GUITARFISH

10.2

Acroteriobatus blochii (Müller & Henle, 1841)

LC

IDENTIFICATION. Medium-sized guitarfish with a shovel-shaped disc, short and bluntly pointed snout, anterior nasal flaps extending across internasal space and close together (separated only by a short interspace), single dermal fold on posterior margin of spiracle, and plain brownish dorsally. Disc thin, length 1.1 times disc width; anterior margins slightly convex, outer corner of pectoral fins broadly rounded. Snout angle ~95°, eyes larger than spiracles; orbit length 2.8–3.1 in preorbital length, 1.1–1.3 in interorbital space. Rostral ridges broadly separated. Spiracle with single fleshy fold. Nostrils large and oblique, length equal to or slightly longer than internasal space; anterior nasal flaps barely separated in internasal space. Skin velvety, entirely covered with minute denticles; ring of small thornlets above orbits but no enlarged thorns; median row of ~28 small thornlets from nape to first dorsal fin, ~8 in interdorsal space, and ~4 on caudal peduncle; all thornlets disappear during growth. Tail 1.6–1.8 times longer than disc; rather large dorsal fins, widely spaced, interspace 2.2–2.3 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials 63–69. Total vertebral centra 173–180.

COLOUR. Dorsal surface uniform brownish in adults; young with a pattern of symmetrical ocelli with a light centre and cloudy dark rim, ocelli gradually disappear with growth. Ventral surface uniformly white.

SIZE. Reaches 96 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic; Cape Province (South Africa) to Namibia, common in Walvis Bay. Records from Angola, Senegal and Mauritania are doubtful. Benthic in shallow sandy bays. Biology virtually unknown.

SIMILAR SPECIES. Off southern Africa, the only guitarfish with a short and bluntly rounded snout. A pattern of white ocelli present in juveniles resembles that of the longer-snouted Whitespotted Guitarfish (10.17) from West Africa.

GREYSPOT GUITARFISH

10.3

Acroteriobatus leucospilus (Norman, 1926)

DD

IDENTIFICATION. Large guitarfish with a wedge-shaped disc, short and narrowly triangular snout, anterior nasal flaps extending across internasal space (almost joined), and dorsal surface with a pattern of symmetrical bluish blotches on snout, and pectoral and pelvic-fin margins. Disc rather thick, length ~1.1 times its width; anterior margins weakly undulate, almost straight; outer corner of pectoral fins mostly rounded. Snout angle ~80°; eye larger than spiracles; orbit length ~4.7 in preorbital length, ~1.3 in interorbital space. Rostral ridges narrowly separated for most of their length. Spiracle with 2 fleshy folds, outer more prominent. Tooth rows in upper jaw 42–51. Nostrils large and oblique, length about equal to internasal space; anterior nasal flaps barely separated in internasal space. Skin velvety, entirely covered with minute denticles; no enlarged thorns but ~7 minute thornlets above orbits, 3–4 above spiracle, 1–2 on shoulders; median row of up to 50 minute thornlets from nape to first dorsal fin; all thornlets disappear during growth, no interdorsal thornlets. Tail ~1.6 times longer than disc; large dorsal fins widely spaced, interspace ~2.7 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials 68–72. Total vertebral centra 186–192.

COLOUR. Dorsal surface sandy brown with a number of symmetrically arranged bluish grey blotches on margins of disc and pelvic fins, also a few symmetrically arranged brown blotches on back of trunk; dorsal and caudal fins faint grey, with brown spots. Ventral surface white, sometimes with a few faint dark spots on snout tip.

SIZE. Reaches at least 120 cm TL, commonly 92–96 cm TL. Males and females mature at ~56 cm TL; birth size ~25 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; Mozambique to Natal (South Africa). Benthic on the continental shelf, inshore to 100 m depth. Feeds on benthic invertebrates and small bony fishes. Produces litters of 2–9 pups.

SIMILAR SPECIES. Resembles the Stripenose Guitarfish (10.7), but the latter has three brown bands on each side of the snout. Distinguished from the Lesser Guitarfish (10.1) and Speckled Guitarfish (10.4) in having plain bluish blotches that are not dark edged.

SPECKLED GUITARFISH

10.4

Acroteriobatus ocellatus (Norman, 1926)

DD

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, short and narrowly triangular snout, anterior nasal flaps extending across internasal space and barely separated, and dorsal surface with numerous small blue-grey eyespots ringed with dark brown. Disc rather thick, length 1.1 times its width; anterior margins slightly undulate to almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~60°; eye larger than spiracles; orbit length ~4 in preorbital length, 0.9–1.2 times interorbital space. Rostral ridges narrowly separated. Spiracle with 2 prominent fleshy folds. Tooth rows in upper jaw ~70. Nostrils large and oblique, length usually longer than internasal space; anterior nasal flaps barely separated in internasal space. Skin velvety, entirely covered with minute denticles; no enlarged thorns, a rim of minute thornlets above orbits and spiracles, 2 on shoulders, and a median row of minute thornlets from nape to first dorsal fin often present; no interdorsal thornlets. Tail ~1.7 times longer than disc; large dorsal fins widely spaced, interspace ~3 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials ~76. Total vertebral centra ~221.

COLOUR. Dorsal surface brownish with numerous small ocelli consisting of a bluish grey centre surrounded by a dark brownish rim. Ventral surface creamy white.

SIZE. Reaches at least 81 cm TL (specimen was an adult male).

HABITAT AND BIOLOGY. South-West Indian Ocean; Mozambique to Natal (South Africa). Benthic inshore on outer continental shelf at depths of 60–185 m. Life history unknown.

SIMILAR SPECIES. Resembles the Lesser Guitarfish (10.1); in the latter the ocelli are dark edged with their centres either brownish or consisting of a dark spot surrounded by a pale ring.

OMAN GUITARFISH

10.5

Acroteriobatus omanensis Last, Henderson & Naylor, 2016

NE

IDENTIFICATION. Small guitarfish with a wedge-shaped disc, moderately elongate and narrowly triangular snout, anterior nasal flaps extending well across internasal space and barely separated, and dorsal surface with dense pattern of white ocelli. Disc rather thin, length 1.3–1.4 times its width; anterior margins undulate, moderately concave before snout tip, outer corner of pectoral fins broadly rounded. Snout angle ~64°; eye large, much larger than spiracles; orbit length 3.1–3.7 in preorbital length, 1.1–1.4 in interorbital space. Rostral ridges well separated at their base. Spiracle with 2 fleshy folds, inner fold rudimentary. Nostrils rather large and oblique, length 1.2–1.3 times internasal space; anterior nasal flaps barely separated. Skin velvety, entirely covered with minute denticles; no thorns or thornlets, some barely enlarged denticles on preorbit and in median row between nape and first dorsal fin. Tail 1.3–1.4 times longer than disc; tall dorsal fins widely spaced, interspace 2.7–3.2 times base length of first dorsal fin; apices angular to narrowly rounded. Pectoral-fin radials 67–72. Total vertebral centra 185–188.

COLOUR. Dorsal surface brownish with numerous small symmetrically arranged ocelli consisting of a white centre surrounded by a dark brownish rim. Ventral surface uniformly whitish, sometimes with dark blotch at snout tip.

SIZE. Reaches at least 60 cm TL; maturity size unknown but a 50 cm TL male was mature.

HABITAT AND BIOLOGY. Northern Indian Ocean; off Oman. Probably benthic on inner continental shelf. Life history unknown.

SIMILAR SPECIES. The Salalah Guitarfish (10.6) occurs in the same region but has a more bluntly rounded snout and fewer and large bluish eyespots on the upper disc. Other members of the genus differ in body shape and/or dorsal coloration.

SALALAH GUITARFISH 10.6

Acroteriobatus salalah (Randall & Compagno, 1995)

DD

IDENTIFICATION. Small to medium-sized guitarfish with a heart-shaped disc, very broad triangular snout, anterior nasal flaps barely separated in internasal space, weakly convex mouth, no enlarged thorns on body, and upper surface with dark-edged, pale bluish eyespots. Disc rather thin, length ~1.1 times its width; anterior margins of snout concave, outer corner of pectoral fins broadly rounded. Snout short, angle ~88°, tip broadly rounded; orbit length 3.3–3.6 in preorbital length, slightly shorter than interorbital space. Rostral ridges well separated. Outer fold of spiracle distinctly larger than inner fold. Tooth rows in upper jaw ~69. Nostrils rather narrow with ~41 nasal lamellae, width 1.1–1.2 times internasal width; oblique with a suboval anterior aperture; anterior nasal flaps almost joined, their interspace almost a third of internasal width. Skin velvety, entirely covered with minute denticles; additional clusters of slightly enlarged denticles around and between eyes, on each shoulder, and along mid-line of disc and tail. Tail 1.5–1.6 times longer than disc; dorsal fins rather widely spaced, interspace 2.8–3 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials ~67. Total vertebral centra ~179.

COLOUR. Dorsal surface yellowish brown with dense pattern of faint bluish spots; spots dark edged, rather regularly spaced, their diameter ~5–7 mm in adults; rostral cartilage not strongly contrasted with rest of snout. Ventral surface white, semi-translucent, and sometimes with dark blotch on snout. Dorsal fins yellowish brown, often faintly blotched.

SIZE. To at least 78 cm TL. Males mature at ~62 cm TL; born at ~18 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; Oman to Pakistan (Arabian Sea). Demersal inshore on inner continental shelf. Produces litters of 1–6 pups.

SIMILAR SPECIES. The Bluntnose Guitarfish (10.2), which occurs in the South-West Indian Ocean, also has a similar heart-shaped disc, but has a single spiracular fold (rather than 2) and lacks enlarged denticles that are obvious on the interorbit of the Salalah Guitarfish.

STRIPENOSE GUITARFISH

10.7

Acroteriobatus variegatus (Nair & Lal Mohan, 1973)

DD

IDENTIFICATION. Small to medium-sized guitarfish with a wedge-shaped disc, triangular snout, anterior nasal flaps barely separated in internasal space, weakly convex mouth, distinct row of thorns on mid-line of body, and upper surface brownish with bluish markings on snout and along hind margins of disc. Disc rather thin, length ~1.3 times its width; anterior margins of snout almost straight, outer corner of pectoral fins broadly rounded. Snout moderately elongate, angle ~65°, tip bluntly pointed; orbit length 4–4.3 in preorbital length, slightly larger than interorbital space. Rostral ridges well separated. Outer fold of spiracle distinctly larger than inner fold. Nostrils rather narrow, width 1.1–1.3 times internasal width; oblique with a suboval anterior aperture; anterior nasal flaps almost joined, their interspace less than 2/3 of internasal width. Skin velvety, entirely covered with minute denticles; lacking thorns but rows of enlarged denticles near eye and spiracle, along mid-line of body, and on shoulder; denticles on interorbit not obviously larger than those adjacent. Tail 1.4–1.6 times longer than disc; dorsal fins small, rather widely spaced, interspace 2.7–2.9 times base length of first dorsal fin; apices narrowly rounded to pointed.

COLOUR. Dorsal surface uniformly rich yellowish brown with dense coverage of pale blotches; snout pale translucent to bluish with short golden bars and spots; rear margins of disc and pelvic fins golden with a few bluish lines. Ventral surface white, semi-translucent or white on snout and around posterior margin of disc; blotch sometimes present at snout tip in juveniles and sometimes adults. Dorsal fins yellowish brown.

SIZE. To at least 75 cm TL; males mature at ~58 cm TL, females by 62 cm TL; born at 18–20 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; endemic to southern India. Demersal, primarily inshore on continental shelf at mainly 10–40 m depths. Reports from upper slope to 366 m are probably erroneous. Produces litters of up to 6 pups.

SIMILAR SPECIES. Very similar to the Zanzibar Guitarfish (10.8). Subtle differences exist in the mitochondrial DNA of these forms but no morphological features distinguishing them have been found. More research is needed to determine their validity.

ZANZIBAR GUITARFISH

10.8

Acroteriobatus zanzibarensis (Norman, 1926)

NT

IDENTIFICATION. Small to medium-sized guitarfish with a wedge-shaped disc, triangular snout, anterior nasal flaps barely separated in internasal space, weakly convex mouth, no enlarged thorns on body, and upper surface covered with bluish spots and darker blotches. Disc rather thin, length 1.3–1.4 times its width; anterior margins of snout almost straight, outer corner of pectoral fins broadly rounded. Snout moderately elongate, angle ~63–66°, tip bluntly pointed; orbit length ~4.5 in preorbital length, slightly longer than interorbital space. Rostral ridges well separated. Outer fold of spiracle distinctly larger than inner fold. Tooth rows in upper jaw ~80. Nostrils rather narrow with ~42 nasal lamellae, width ~1.5 times internasal width; oblique with a suboval anterior aperture; anterior nasal flaps almost joined, their interspace about a third of internasal width. Skin granular, entirely covered with minute denticles; lacking thorns but some slightly enlarged denticles near eye and along midline of body; denticles on interorbit not larger than those adjacent. Tail 1.4–1.5 times longer than disc; dorsal fins small, rather widely spaced, interspace 2.4–2.9 times base length of first dorsal fin; apices narrowly rounded to pointed.

COLOUR. Dorsal surface pale yellowish brown with dark brownish blotches over central disc and tail; snout pale blue with short golden bars; a few large bluish spots along rear margins of disc and pelvic fins. Ventral surface white; snout and posterior margin of disc semi-translucent; large dark blotch sometimes at snout tip. Dorsal fins yellowish brown.

SIZE. To at least 75 cm TL, reports to 205 cm TL are likely to be erroneous. Males mature at ~64 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; possibly endemic to Zanzibar. Benthic on inner continental shelf. Caught rarely and life history unknown.

SIMILAR SPECIES. Shares a characteristic blue-striped snout with the Stripenose Guitarfish (10.7). Some subtle shape differences exist between these species but more work is needed to determine their relationship.

SPECKLED GUITARFISH

10.9

Pseudobatos glaucostigmus (Jordan & Gilbert, 1883)

DD

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, moderately long and narrowly triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), brownish above with round bluish blotches, and a conspicuous black blotch near ventral snout tip. Disc rather thick, length 1.1 times its width; anterior margins almost straight, outer corner of pectoral fins bluntly angular. Snout angle ~65°; eye about twice spiracle length, length ~4.2 in preorbital length, 1–1.1 in interorbital space. Rostral ridges rather broad, separated throughout their length, nearly parallel. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length greater than internasal space; anterior nasal flaps extending only slightly into internasal space to inner corner of nostrils. Skin entirely covered with fine denticles; thornlets around orbits, above spiracles, on each shoulder, and a median row on back and interdorsal space. Tail 1.6–1.7 times longer than disc; large dorsal fins widely spaced, apices bluntly pointed.

COLOUR. Dorsal surface brownish grey, covered with series of round slate-coloured blotches; blotches mostly on head, and more or less symmetrically arranged. Ventral surface white, with a conspicuous, black tear-shaped blotch on snout tip.

SIZE. Reaches 89 cm TL; size of maturity unknown.

HABITAT AND BIOLOGY. Eastern Central Pacific; Mexico (Baja California, including the Gulf of California) to Ecuador. Benthic, coastal to mid-continental shelf to a depth of 110 m. Adults feed on prawns and crabs, juveniles mainly amphipod crustaceans.

SIMILAR SPECIES. In the Eastern Pacific, the only member of the genus *Pseudobatos* that possesses a pattern of bluish blotches on the dorsal surface.

BRAZILIAN GUITARFISH

10.10

Pseudobatos horkelii (Müller & Henle, 1841)

CR

IDENTIFICATION. Large guitarfish with a wedge-shaped disc, long and narrowly triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and plain olive grey to brownish above with conspicuous, dark oval blotch near ventral snout tip. Disc moderately thick, length ~1.4 times its width; anterior margins almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~55°; eyes about as large as spiracles, orbit length ~4.5 in preorbital length, 1.4–1.6 in interorbital space. Rostral ridges rather narrow, separated throughout their length. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length greater than internasal space; anterior nasal flaps not crossing internasal space. Skin entirely covered with fine denticles; thornlets on rostrum, around orbits, above spiracles, on each shoulder, a median row on back and between dorsal fins. Tail ~1.4 times longer than disc; large dorsal fins widely spaced, apices acutely rounded.

COLOUR. Dorsal surface plain olive grey to chocolate brown. Ventral surface white, outer margins of pectoral and pelvic fins somewhat dusky, a small but conspicuous sooty oval blotch on snout tip.

SIZE. Reaches ~138 cm TL. Females mature at ~90 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; Brazil to Argentina. Benthic, coastal from nearshore to outer continental shelf to a depth of 150 m. Females produce litters of 4–12 pups. Feeds on crustaceans, molluscs, polychaete worms and small bony fishes.

SIMILAR SPECIES. Thought to be the only plain-coloured *Pseudobatos* in the Western Atlantic but likely to be a variant of the typically white-spotted Chola Guitarfish (10.13).

FRECKLED GUITARFISH

10.11

Pseudobatos lentiginosus (Garman, 1880)

NT

IDENTIFICATION. Small to medium-sized guitarfish with a wedge-shaped disc, moderately long and triangular snout becoming somewhat spatulate at tip, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and a dense pattern of white spots dorsally. Disc moderately thick, length 1.2–1.3 times its width; anterior margins almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~65°; eye about twice spiracle length, length ~4.5 in preorbital length, 1.1–1.2 in interorbital space. Rostral ridges rather broad, narrowly separated throughout their length, nearly parallel. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length slightly greater than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; thornlets on snout tip (conical and somewhat larger), around orbits, above spiracles, on each shoulder, and in median row on back. Tail 1.5 times longer than disc; large dorsal fins widely spaced, apices acutely rounded.

COLOUR. Dorsal surface greyish to chocolate brown, densely freckled with numerous small white spots over most of the dorsal surface. Ventral surface pale yellowish.

SIZE. Reaches 78 cm TL. Birth size ~20 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina (USA) to Nicaragua, reports from Brazil need confirmation. Benthic, coastal from shore to 30 m depth. Produces litters of up to 6 pups. Feeds on benthic molluscs and crustaceans.

SIMILAR SPECIES. Distinguishable from other *Pseudobatos* species of the Western Atlantic by their strong colour pattern consisting of numerous white spots; the Brazilian Guitarfish (10.10) is plain coloured and the Chola Guitarfish (10.13) has a pattern of dark blotches.

WHITESNOUT GUITARFISH

10.12

Pseudobatos leucorhynchus (Günther, 1867)

NT

IDENTIFICATION. Small guitarfish with a wedge-shaped disc, moderately long and triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and plain brownish dorsally with edges of snout translucent. Disc rather thick, length 1.2–1.3 times its width; anterior margins almost straight, outer corner of pectoral fins mostly bluntly acute. Snout angle ~65°; eyes about twice spiracle length, length ~5.5 in preorbital length, 1–1.1 in interorbital space. Rostral ridges rather narrow, separated throughout their length, but converging anteriorly. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length greater than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; thornlets around orbits, above spiracles, on each shoulder, and in median row on back. Tail ~1.4 times longer than disc; large dorsal fins widely spaced, apices acutely rounded.

COLOUR. Dorsal surface plain brownish to greenish brown; snout area, including rostrum, translucent (more hyaline than in other species). Ventral surface white, outer margins of pectoral and pelvic fins somewhat dusky.

SIZE. Reaches 70 cm TL (reports to 118 cm probably erroneous). Females mature at ~48 cm TL and males at ~51 cm TL, birth size ~19 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Baja California (Mexico) to Ecuador, including Galapagos Islands. Benthic, mainly coastal near the shore to 50 m depth. Produces litters of 1–6 pups.

SIMILAR SPECIES. Resembles another plain-coloured guitarfish from the eastern Pacific, the Pacific Guitarfish (10.14). However, they differ by the appearance of the snout; conspicuously translucent in the Whitesnout Guitarfish rather than being the same colour as the rest of the head in the Pacific Guitarfish.

CHOLA GUITARFISH

10.13

Pseudobatos percellens (Walbaum, 1792)

NT

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, moderately long and narrowly triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and dorsal surface with pattern of white spots and cloudy dark blotches. Disc moderately thick, length 1.2–1.3 times its width; anterior margins almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~65°; eyes about twice spiracle length, length ~3.5 in preorbital length, 1–1.4 in interorbital space. Rostral ridges rather narrow, separated throughout their length, converging anteriorly, diverging posteriorly. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length slightly greater than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; thornlets around orbits, above spiracles, on each shoulder, and in a median row on back. Tail 1.2–1.3 times longer than disc; large dorsal fins widely spaced, apices bluntly pointed.

COLOUR. Dorsal surface greyish brown, with cloudy dark blotches (sometimes indistinct) and conspicuous small white spots scattered on disc and tail. Ventral surface whitish, outer margins of pectoral and pelvic fins somewhat dusky, faint greyish spots on snout tip.

SIZE. Reaches ~100 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Caribbean to Brazil, and possibly further south to northern Argentina. Benthic, coastal from nearshore to 110 m depth. Biology largely unknown.

SIMILAR SPECIES. Distinct from most other Western Atlantic *Pseudobatos* by its striking pattern of white spots, much less numerous and larger than those of the Freckled Guitarfish (10.11). The Brazilian Guitarfish (10.10) is likely to be a junior synonym.

PACIFIC GUITARFISH

10.14

Pseudobatos planiceps (Garman, 1880)

DD

IDENTIFICATION. Large guitarfish with a wedge-shaped disc, moderately long and narrowly triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and typically plain olive brown above. Disc moderately thick, length 1.1–1.2 times its width; anterior margins almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~65°; eyes about twice spiracle length; orbit length ~5.1 in preorbital length, 1.1–1.6 in interorbital space. Rostral ridges rather broad, well separated throughout their length, nearly parallel. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length greater than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; thornlets around orbits above spiracles, on each shoulder, and in a median row on back, attenuating with growth. Tail ~1.6 times longer than disc; large dorsal fins widely spaced, apices acutely rounded.

COLOUR. Dorsal surface plain olive brown, sometimes with a few small white spots. Ventral surface white, sometimes with a black blotch on snout tip.

SIZE. Reaches at least 114 cm TL, questionable reports to 170 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; southern Mexico to northern Chile, including Galapagos Islands. Benthic, mainly coastal. Biology unknown.

SIMILAR SPECIES. Resembles the Whitesnout Guitarfish (10.12) in being plain coloured but they differ in the appearance of the snout; conspicuously translucent in the Whitesnout Guitarfish and the same colour as the rest of the head in the Pacific Guitarfish.

GORGONA GUITARFISH

10.15

Pseudobatos prahli (Acero & Franke, 1995)

DD

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, rather short and triangular snout with a broad tip, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), dorsal pattern of cloudy dark blotches and small white spots, and conspicuous black markings on snout tip and along anterior margins of ventral disc. Disc rather thick, length 1.2–1.3 times its width; anterior margins slightly undulate, outer corner of pectoral fins mostly rounded. Snout spatulate, angle ~65°; eye about twice size of spiracle, length ~3 in preorbital length, 1–1.1 in interorbital space. Rostral ridges rather broad, separated throughout most of their length, converging anteriorly, diverging posteriorly. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length greater than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; thornlets around orbits, above spiracles, on each shoulder, and in a median row. Tail ~1.6 times longer than disc; large dorsal fins widely spaced, apices bluntly pointed.

COLOUR. Dorsal surface brownish with symmetrical pattern of large, dark cloudy blotches and small white spots; orbits blackish. Ventral surface white or mottled grey, outer margins of pectoral fins blackish; a conspicuous tear-shaped black blotch on snout tip, anterior margins of snout with a narrow black stripe, connected or not to snout blotch; sometimes with black blotches on anterior gills and each side of mouth.

SIZE. Reaches at least 90 cm TL, males mature at ~71 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Mexico to northern Peru. Benthic, coastal and on inner continental shelf from shore to 70 m depth. Biology unknown.

SIMILAR SPECIES. Distinctive guitarfish of the Eastern Pacific, being the only *Pseudobatos* species with prominent colour patterns on both dorsal and ventral surfaces.

SHOVELNOSE GUITARFISH

10.16

Pseudobatos productus (Ayres, 1854)

NT

IDENTIFICATION. Very large guitarfish with a wedge-shaped disc, moderately long and narrowly triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and plain olive green or mottled with dark cloudy blotches above. Disc moderately thick, length 1.2–1.3 times its width; anterior margins almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~60°; eyes slightly larger than spiracle, length ~4.3 in preorbital length, 1–1.1 in interorbital space. Rostral ridges rather narrow, almost separated throughout their length, strongly converging anteriorly, diverging posteriorly. Spiracle with 2 distinct fleshy folds, inner fold smaller. Nostrils large and oblique, length slightly greater than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; thornlets on rostral ridges, around orbits, above spiracles, on each shoulder, and in a median row on back and between dorsal fins; thornlets reducing with growth. Tail 1.3–1.4 times longer than disc; large dorsal fins widely spaced, apices acutely rounded.

COLOUR. Dorsal surface brownish mottled with cloudy irregular dark blotches, more or less symmetrically arranged. Ventral surface white, snout tip sometimes with blackish margins.

SIZE. Reaches 170 cm TL. Females mature at 87–99 cm TL, males at 91–110 cm TL; birth size 20–24 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; California (USA) to Mexico, including Gulf of California. Benthic, coastal in bays and estuaries inshore to 90 m depth. Females mature at 7 years and produce litters of 1–16 pups. Feeds on crabs, worms, clams and small bony fishes.

SIMILAR SPECIES. Resembles the Pacific Guitarfish (10.14) but differs by its pattern of dark cloudy blotches (otherwise plain or with a few white spots).

WHITESPOTTED GUITARFISH

10.17

Rhinobatos albomaculatus Norman, 1930

VU

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, long and narrowly triangular snout, anterior nasal flaps moderately developed with inner margin extending slightly into internasal space, and greenish brown dorsally with symmetrical pattern of numerous small, pale spots with dark rims. Disc moderately thick, length ~1.1 times its width; anterior margins slightly undulate, almost straight, outer corner of pectoral fins mostly rounded. Snout acute, angle ~60°; eye large, length 4–4.7 in preorbital length, 1.1–1.4 in interorbital space. Rostral ridges separated by a large interspace throughout their length. Spiracle with 2 distinct fleshy folds. Tooth rows in upper jaw 68–131 (number increases with age). Nostrils oblique, length ~1.3 times internasal space; anterior nasal flaps extending into internasal space to inner corner of nostrils. Skin entirely covered with fine denticles; a few thornlets around orbits; median row of blunt thornlets from nape to first dorsal fin and a few between dorsal fins. Tail ~1.4 times longer than disc; large dorsal fins widely spaced, apices mostly angular. Pectoral-fin radials 68–71. Total vertebral centra 177–192.

COLOUR. Dorsal surface greenish brown with a pattern of numerous small, circular, bluish white spots surrounded with blackish rims, and symmetrically arranged on disc and trunk. Ventral surface plain white.

SIZE. Reaches 80 cm TL, commonly 50–60 cm TL. Males mature at ~46 cm TL and females ~52 cm TL; birth size ~15 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Senegal to Angola. Benthic on sandy bottoms, coastal to depth of 35 m. Feeds mainly on benthic invertebrates, mostly shrimps. Produces small litters of 2–3 pups.

SIMILAR SPECIES. The smallest guitarfish off West Africa. It has a unique coloration consisting of a symmetrical pattern of light spots, no thorns on shoulders, and thorns of mid-dorsal row blunt (often indistinct in large specimens).

BENGAL GUITARFISH

10.18

Rhinobatos annandalei Norman, 1926

DD

IDENTIFICATION. Medium-sized guitarfish with a very broad, wedge-shaped disc, long and pointed triangular snout, oblique nostrils with suboval anterior apertures, prominent thorns around eyes and along mid-line of body, and upper surface with small, widely spaced white spots. Disc thin, length 1.1 times its width; anterior margins almost straight, outer corner of pectoral fins broadly rounded to abruptly angular. Snout obtuse, angle ~68°, tip bluntly pointed; orbit length 3.6–4.3 in preorbital length, 1.2–1.3 in interorbital space. Rostral ridges well separated. Both folds of spiracle well developed, outer fold slightly taller than inner fold. Mouth width 2.3–2.5 in preoral snout length. Nostrils with ~59 nasal lamellae, width 1.3–1.4 times internasal width; anterior nasal flaps penetrating only slightly into internasal space, their interspace about equal to internasal width. Skin smooth to touch, almost entirely covered with minute denticles. Thorns well developed and spiny, most prominent in adult males. Tail 1.2–1.3 times longer than disc; dorsal fins not widely spaced, interspace 2.2–2.4 times base length of first dorsal fin; apices narrowly rounded to angular. Pectoral-fin radials 67–69. Total vertebral centra 161–165.

COLOUR. Dorsal surface and fins greyish to brownish with symmetrical pattern of small white spots; spots widely spaced, of similar size (each a few mm in diameter); disc paler beside rostral shaft. Ventral surface white with broad greyish brown patches on disc and tail, and yellowish areas around gills; usually translucent on snout either side of rostral shaft.

SIZE. To at least 80 cm TL. Males mature by 68 cm TL, born at ~20 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; Oman to India (Bay of Bengal). Primarily benthic inshore on inner continental shelf to 90 m depth. Produces litters of up to 6 pups.

SIMILAR SPECIES. Often confused with the Spotted Guitarfish (10.27), which can also have a similar pattern of small, widely spaced white spots. The Bengal Guitarfish has a relatively broader disc with longer spiny thorns along the dorsal mid-line.

BORNEO GUITARFISH

10.19

Rhinobatos borneensis Last, Séret & Naylor, 2016

NE

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, snout bottle-shaped, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), no thorns or thornlets on body, body plain brownish above or with faint orange-brown blotches, and no dark blotch on snout undersurface. Disc moderately thick, length 1.3–1.4 times its width; anterior margins undulate, most concave near tip, outer corner of pectoral fins bluntly rounded. Snout angle ~56–57°; moderately long and narrowly triangular, eyes large, length 3.1–4.4 in preorbital length, 1.1–1.5 times interorbital space. Rostral ridges separated almost throughout their length, slightly more widely separated posteriorly. Spiracle with 2 prominent fleshy folds, inner fold smaller. Tooth rows in upper jaw 90–91. Nostrils oblique, length 1.5–1.7 times internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin finely granular, entirely covered with fine denticles; patch of slightly enlarged denticles around orbit and similar denticles in median row from nape to first dorsal fin. Tail 1.4–1.5 times longer than disc; tall, short-based dorsal fins widely spaced, interspace 2.5–3.3 times base length of first dorsal fin; apices angular in adults. Pectoral-fin radials 66–67. Total vertebral centra 176–180.

COLOUR. Dorsal surface medium brown with darker orange-brown blotches; blotches irregular; young greyish with faint pale ocelli. Ventral surface white; snout greyish white but lacking dark tear-shaped blotch. Tips of dorsal and caudal fins darker than their bases (tips with black blotches in young).

SIZE. Reaches at least 90 cm TL. Matures at ~63 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; South China Sea off Borneo. Probably benthic on continental shelf. Biology poorly known. Pregnant female had 6 pups.

SIMILAR SPECIES. Similar to the Philippine Guitarfish (10.31) but the Borneo Guitarfish differs significantly in its mitochondrial DNA, has a relatively longer tail and lacks white spots on the upper surface.

SLENDER GUITARFISH

10.20

Rhinobatos holcorhynchus Norman, 1922

DD

IDENTIFICATION. Large guitarfish with a wedge-shaped disc, long and narrowly triangular snout, large eyes, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), dorsal surface plain olive green, and a conspicuous black blotch near ventral snout tip. Disc rather thick, length 1.2–1.3 times its width; anterior margins almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~65°; eye about twice spiracle length, length ~4.5 in preorbital length, 1–1.1 in interorbital space. Rostral ridges separated throughout their length. Spiracle with 2 distinct fleshy folds, inner fold smaller. Tooth rows in upper jaw 46–47. Nostrils large and oblique, length almost twice internasal space; anterior nasal flaps extending only slightly into internasal space, to inner corner of nostrils. Skin entirely covered with fine denticles; thornlets on rostrum, around orbits and above spiracles, 1–2 on each shoulder, median row of up to 32 large tubercular thorns alternating with smaller ones; row of ~10 thornlets between dorsal fins. Tail 1.3–1.4 times longer than disc; large dorsal fins widely spaced, apices acutely rounded. Pectoral-fin radials 71–73. Total vertebral centra 199–203.

COLOUR. Dorsal surface plain olive brown. Ventral surface white, outer margins of pectoral and pelvic fins somewhat dusky, a conspicuous tear-shaped black blotch on snout tip.

SIZE. Reaches 127 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; Kenya to Natal (South Africa). Benthic, mainly on continental shelf, but reported from 75–350 m depths. Taken as bycatch of trawl and gillnet fisheries, biology largely unknown.

SIMILAR SPECIES. Only species of the genus *Rhinobatos* found in the South-West Indian Ocean; most guitarfishes of this region belong to the genus *Acroteriobatus*.

RINGED GUITARFISH

10.21

Rhinobatos hynnicephalus Richardson, 1846

NT

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, rather short and broad snout, oblique nostrils with a subcircular anterior aperture, anterior nasal flaps penetrating slightly into internasal space, weakly convex to straight mouth, thorns minute or absent on body, and upper surface pale with complex pattern of small dark rings and spots. Disc rather thin, length ~1.2 times its width; anterior margins of snout almost straight, outer corner of pectoral fins broadly rounded. Snout angle ~68°, tip rather broadly rounded; orbit length 4.3–4.7 in preorbital length, 1–1.2 in interorbital space. Rostral ridges well separated. Outer fold of spiracle prominent, inner fold obscure or absent. Nostrils rather narrow, width 1.1–1.5 times internasal width; anterior nasal flaps not crossing internasal space, their interspace about equal to internasal width. Skin coarsely granular, entirely covered with minute denticles. Thorns barely detectable; sometimes slightly larger near eye and along mid-line of body. Tail 1.4–1.6 times longer than disc; dorsal fins rather narrowly spaced, interspace 2.2–2.6 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials 60–64. Total vertebral centra 165–175.

COLOUR. Dorsal surface pale yellowish to greyish brown with variable pattern of small dark spots; spots either in small to large clusters or free, forming lines around eyes; fins and snout beside rostral cartilage largely pale. Ventral surface white; most of snout and outer pectoral fins translucent.

SIZE. To at least 62 cm TL. Males mature at 38–40 cm TL, females at 39–44 cm TL; born at ~16 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Japan to Vietnam, including Taiwan. Demersal, inshore on continental and insular shelves. Litters of 2–9 pups.

SIMILAR SPECIES. Occurs together with the Bottlenose Guitarfish (10.30) but has broader snout and prominent ring-like markings on the disc.

SPINEBACK GUITARFISH

10.22

Rhinobatos irvinei Norman, 1931

VU

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, moderately long and narrowly triangular snout, anterior nasal flaps moderately developed with inner margin extending into internasal space to level of nostril inner corner, and greenish brown dorsally with a dense pattern of irregular white blotches rimmed with dark spots. Disc moderately thick, length 1.2–1.3 times its width; anterior margins slightly undulate, almost straight, outer corner of pectoral fins mostly rounded. Snout acute, angle ~60°; eye large, length ~3 in preorbital length, about equal to interorbital space. Rostral ridges separated by large interspace throughout their length. Spiracle with 2 distinct fleshy folds. Tooth rows in upper jaw ~69–72. Nostrils oblique, length about equal to internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; a few thornlets around orbits and above spiracles, 3 on each shoulder, a median row of pointed thornlets from nape to first dorsal fin and a few between dorsal fins; thornlets persistent in adults. Tail ~1.4 times longer than disc; large dorsal fins widely spaced, apices acutely rounded. Pectoral-fin radials 63–71. Total vertebral centra 171–183.

COLOUR. Dorsal surface greenish brown with a distinctive ocellate pattern of pale orange blotches with dark margins, and black spots; ocelli more or less arranged in rows on trunk and forming a typical X-shaped marking on interorbital space. Ventral surface white.

SIZE. Reaches ~100 cm TL, commonly 60–66 cm TL. Males mature at ~42 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Morocco to southern Angola, a record from Namibia needs confirmation. Benthic on soft bottoms of inner continental shelf, coastal to 30 m depth. Feeds on benthic invertebrates, mainly crustaceans. Produces small litters of 1–3 pups.

SIMILAR SPECIES. Distinguishable from the Whitespotted Guitarfish (10.17), which also occurs off West Africa, by its pattern of irregularly shaped orange ocelli (*vs.* circular spots with dark rims), persistent pointed thornlets on shoulders and mid-dorsal row (*vs.* thornlets disappearing with growth and absent from shoulders).

JIMBARAN GUITARFISH

10.23

Rhinobatos jimbaranensis Last, White & Fahmi, 2006

VU

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, long and narrow bottle-shaped snout, oblique nostrils with subcircular anterior aperture, anterior nasal flaps penetrating slightly into internasal space, rudimentary thorns on body, and upper surface dark blotched but without white spots. Disc thin, length 1.3–1.4 times its width; anterior margins of snout strongly concave, outer corner of pectoral fins broadly rounded. Snout angle ~59–60°, tip narrowly rounded; orbit length 4.5–4.8 in preorbital length, 1–1.2 times interorbital space. Rostral ridges well separated. Outer fold of spiracle slightly larger than inner fold. Tooth rows in upper jaw 62–77. Nostrils with 51–55 nasal lamellae, rather narrow; nostril width 1.3–1.4 times internasal width; anterior nasal flaps barely penetrating internasal space, their interspace about equal to internasal width. Skin coarsely granular, entirely covered with minute denticles. Thorns very small, often embedded; located near eye, along mid-line of body and on shoulder. Tail 1.3–1.4 times longer than disc; dorsal fins rather widely spaced, interspace 2.5–3.1 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials 67–71. Total vertebral centra 176–180.

COLOUR. Dorsal surface dark greyish brown with faint rusty brown blotches; paler around disc margin and beside rostral shaft. Ventral surface creamy white, often darker around gills. Dorsal fins yellowish brown, their posterior half usually dusky; caudal fin yellowish brown, ventral margin pale. Prenatal juveniles covered with light and dark spots.

SIZE. To at least 99 cm TL. Males mature at 77–80 cm TL, females at ~75 cm TL; born at ~13 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; endemic to central Indonesia. Demersal inshore on inner insular shelf. Produces litters of 6–11 pups. Feeds primarily on small crustaceans.

SIMILAR SPECIES. The Bottlenose Guitarfish (10.30), from further north in the Western Pacific, also has a distinctive bottle-shaped snout. However, these species differ in their mitochondrial DNA and in several morphometric characters, and their ranges do not overlap.

SMOOTHBACK GUITARFISH

10.24

Rhinobatos lionotus Norman, 1926

DD

IDENTIFICATION. Medium-sized guitarfish with a broad wedge-shaped disc, moderately elongate and broadly triangular snout, oblique nostrils with suboval anterior aperture, anterior nasal flaps penetrating well into internasal space, feeble thorns on body, moderately widely spaced dorsal fins, and dorsal surface plain greenish brown with darker brown blotches. Disc thin, length 1.2–1.4 times its width; anterior margins weakly undulate, outer corner of pectoral fins usually broadly rounded. Snout angle ~62°, tip bluntly pointed; orbit length 3.2–3.6 in preorbital length, subequal to interorbital space. Rostral ridges widely separated. Outer fold of spiracle slightly taller than inner fold. Mouth width ~2.6 in preoral snout length. Nostril width ~1.3 times internasal width; anterior nasal flaps penetrating ~5 mm into internasal space, their interspace subequal to internasal width. Skin finely granular, almost entirely covered with minute denticles. Thorns very short, only slightly larger than adjacent denticles. Tail broad and elongate, 1.4–1.5 times longer than disc; dorsal fins moderately well separated, interspace 2.4–2.8 times base length of first dorsal fin; apices narrowly rounded to angular.

COLOUR. Dorsal surface greenish brown, covered all over with dense symmetrical pattern of darker brown blotches; disc marginally paler beside rostral shaft. Ventral surface white, broad translucent areas on snout beside rostral shaft and around posterior disc margins. Dorsal and caudal fins similar to upper surface colour but with fewer blotches.

SIZE. To ~75 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; upper Bay of Bengal, West Bengal to Myanmar, and possibly in the Arabian Sea. Demersal inshore on the continental shelf to at least 70 m. Confused with other species in the Indian Ocean and biology unknown.

SIMILAR SPECIES. Occurs with the Bengal Guitarfish (10.18) in the Bay of Bengal. The Smoothback Guitarfish lacks white markings typifying the Bengal Guitarfish, has a slightly narrower disc, and relatively longer interdorsal space.

BAREBACK GUITARFISH

10.25

Rhinobatos nudidorsalis Last, Compagno & Nakaya, 2004

NT

IDENTIFICATION. Small plain-coloured guitarfish with a wedge-shaped disc, long and narrow triangular snout, oblique nostrils with subcircular anterior aperture, anterior nasal flaps penetrating well into internasal space, no thorns or tubercles, and upper surface of body almost entirely smooth. Disc thin, length ~1.4 times its width; anterior margins straight to weakly undulate, outer corner of pectoral fins broadly rounded. Snout angle ~60°, tip narrowly rounded; eye large, orbit length ~3.4 in preorbital length, ~1.4 times interorbital space. Rostral ridges well separated. Outer fold of spiracle about twice length of inner fold. Tooth rows in upper jaw ~78. Nostrils rather wide, ~1.7 times internasal width; anterior nasal flap interspace only slightly greater than internarial width. Skin lacking denticles on most of dorsal surface; minute denticles covering most of ventral surface; tail fins smooth apart from their leading edges; caudal peduncle largely smooth with longitudinal patch of denticles on each side. Tail slender, ~1.5 times longer than disc; dorsal fins widely spaced, interspace almost 3 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials ~67. Total vertebral centra ~172.

COLOUR. Dorsal surface pale brownish pink behind eyes, no obvious spots or blotches; snout paler with more translucent skin. Dorsal and caudal fins darker brownish pink. Ventral surface uniformly pinkish or white; oral and nasal areas similar; small dark streak at margin of each side of snout near its apex, but apex lacking a dark central blotch or marking.

SIZE. Only one known specimen, a 50 cm TL adult male.

HABITAT AND BIOLOGY. Central Indian Ocean; Mascarene Ridge. Probably restricted in distribution, offshore on insular shelves of the Central Indian Ocean to at least 125 m depth. Nothing known of its biology and more specimens needed.

SIMILAR SPECIES. Very poorly known and distinctive guitarfish with an unusually patchy coverage of denticles on the body; denticles missing from most of dorsal surface.

INDONESIAN GUITARFISH

10.26

Rhinobatos penggali Last, White & Fahmi, 2006

VU

IDENTIFICATION. Medium-sized guitarfish with a very broad wedge-shaped disc, long and pointed triangular snout, oblique nostrils with suboval anterior aperture, anterior nasal flaps penetrating slightly into internasal space, small thorns on body, and upper surface usually white spotted (spots sometimes faint). Disc thin, length 1.2–1.3 times its width; anterior margins of snout weakly concave, outer corner of pectoral fins broadly rounded to abruptly angular. Snout angle ~61–64°, tip narrowly rounded; orbit length 4.1–4.6 in preorbital length, 0.9–1 times interorbital space. Rostral ridges well separated. Outer fold of spiracle much taller than inner fold. Mouth width 3.1–3.4 in preoral snout length; tooth rows in upper jaw 75–83. Nostrils with 53–57 nasal lamellae, width 1.3–1.4 times internasal width; anterior nasal flap interspace about equal to internasal width. Skin coarsely granular, entirely covered with minute denticles. Thorns well developed, short, broad based; near eye, along mid-line of body and on shoulder. Tail 1.2–1.3 times longer than disc; dorsal fins rather widely spaced, interspace 2.7–2.9 times base length of first dorsal fin; apices narrowly rounded to angular. Pectoral-fin radials 69–73. Total vertebral centra 166–170.

COLOUR. Dorsal surface brownish to dark grey with small, widely spaced white spots (sometimes faint in adults but pronounced in embryos); disc usually palest around its margin and beside rostral shaft. Ventral surface whitish, translucent on snout beside rostral shaft and around posterior disc margin. Dorsal fins usually weakly bicoloured brownish and grey; caudal fin with dusky posterior margin.

SIZE. To at least 99 cm TL. Males mature at 70–72 cm TL, females at 75 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; endemic to central Indonesia. Demersal inshore on inner insular shelf. Produces litters of 4–13 pups. Feeds on small crustaceans and probably small bony fishes.

SIMILAR SPECIES. A broad, white-spotted disc also defines the Bengal Guitarfish (10.18) from the Northern Indian Ocean. These species differ in their mitochondrial DNA and can be identified by the dimension of the mouth and dorsal-fin positions.

SPOTTED GUITARFISH

10.27

Rhinobatos punctifer Compagno & Randall, 1987

DD

IDENTIFICATION. Medium-sized guitarfish with an angular wedge-shaped disc, moderately elongate and broadly triangular snout, oblique nostrils with a suboval anterior aperture, anterior nasal flaps penetrating slightly into internasal space, thorns feeble, and upper surface extremely variable in coloration from almost plain to strongly ocellate. Disc thin, length 1.1–1.2 times its width; anterior margins of snout almost straight, outer corner of pectoral fins usually broadly rounded. Snout angle ~66°, tip bluntly pointed; orbit length 3.2–4 in preorbital length, 0.9–1.2 times interorbital space. Rostral ridges very well separated. Both folds of spiracle well developed, outer fold slightly taller than inner fold. Mouth width 2.7–2.8 in preoral snout length; tooth rows in upper jaw ~76. Nostrils with ~56 nasal lamellae, width 1.4–1.5 times internasal width; anterior nasal flap interspace ~1.2 times shorter than internasal width. Skin finely granular, almost entirely covered with minute denticles. Thorns minute, only slightly larger than adjacent denticles, located near eye, along mid-line of body and on shoulder. Tail elongate, ~1.5 times longer than disc; dorsal fins rather widely spaced, interspace 2.4–2.5 times base length of first dorsal fin; apices narrowly rounded, more angular in adults. Pectoral-fin radials ~71. Total vertebral centra ~179.

COLOUR. Dorsal surface yellowish brown to greyish, usually with small widely spaced white spots or larger ocellate markings (rarely plain); disc palest around margin and beside rostral shaft. Ventral surface white, often yellowish around gill region; translucent on snout beside rostral shaft and around posterior disc margin. Dorsal fins usually bicoloured, pale with dusky posterior half; caudal fin hind margin dusky.

SIZE. To at least 88 cm TL. Matures at ~62 cm TL; born at ~25 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; Red Sea to Pakistan, probably further east. Demersal inshore on continental shelf to 70 m depth. Produces litters of up to 7 pups. Probably feeds on small crustaceans and fishes.

SIMILAR SPECIES. Often confused with the Bengal Guitarfish (10.18), which occurs in similar areas of the Indian Ocean. However, the Spotted Guitarfish has a relatively narrower disc, and much smaller thorns around the eyes and along the mid-line of the body.

COMMON GUITARFISH

10.28

Rhinobatos rhinobatos (Linnaeus, 1758)

EN

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, moderately long and narrowly triangular snout, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), and plain greenish brown to reddish brown above or with faint bluish grey markings. Disc moderately thick, length ~1.2 times its width; anterior margins slightly undulate, outer corner of pectoral fins mostly rounded. Snout angle ~60°; eye large, orbit length 3.2–3.8 in preorbital length, 1–1.4 in interorbital space. Rostral ridges widely separated throughout their length. Spiracle with 2 distinct fleshy folds, inner fold smaller. Tooth rows in upper jaw 70–120. Nostrils oblique, length slightly longer than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered in fine denticles; thornlets on rostral ridges, around orbits, 2–3 on shoulders (persisting in adults); a median row of thornlets from nape to first dorsal fin and between dorsal fins. Tail 1.4–1.6 times longer than disc; large dorsal fins widely spaced, apices acutely rounded. Pectoral-fin radials 68–72. Total vertebral centra 173–182.

COLOUR. Dorsal surface greenish brown to reddish brown, often with faint bluish grey longitudinal stripes and blotches (sometimes with V or X-shaped marking on interorbit); rostral area semi-translucent. Ventral surface white.

SIZE. Reaches ~100 cm TL. Males mature at ~56 cm TL and females at ~64 cm TL; birth size ~25 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic; Bay of Biscay to Angola, also in the Mediterranean Sea. Benthic, coastal and offshore on soft bottoms to 90 m depth. Feeds on benthic invertebrates, mainly crustaceans, and small fishes. Produces litters of 2–7 pups.

SIMILAR SPECIES. Most likely to be confused with the Spineback Guitarfish (10.22) because both species can have an X-like marking between the orbits. However, the Spineback Guitarfish has a distinct pattern of irregular light blotches (rather than being plain or with greenish stripes).

GOLDENEYE GUITARFISH

10.29

Rhinobatos sainsburyi Last, 2004

LC

IDENTIFICATION. Small guitarfish with a wedge-shaped disc, short and broadly triangular snout, oblique nostrils with subcircular anterior aperture, anterior nasal flaps penetrating well into internasal space, no thorns or tubercles on body, and upper surface plain or with faint dark markings. Disc rather thin, length 1.2–1.3 times its width; anterior margins straight to weakly double concave, outer corner of pectoral fins broadly rounded. Snout angle ~66°, tip narrowly rounded; eye large, length 3.3–3.6 in preorbital length, 1–1.4 times interorbital space. Rostral ridges narrowly separated. Outer fold of spiracle distinctly larger than inner fold. Tooth rows in upper jaw ~80. Nostrils with ~51 nasal lamellae; rather wide, length 1.4–1.6 times internasal width in adults; anterior nasal flap interspace about equal to length of posterior nasal aperture. Skin entirely covered with minute denticles. Tail 1.5–1.6 times longer than disc; dorsal fins narrowly spaced, interspace 2.7–3 times base length of first dorsal fin; apices narrowly rounded. Pectoral-fin radials 59–65. Total vertebral centra 175–185.

COLOUR. Dorsal surface uniform pale yellowish brown or variably covered with faint dusky or rusty blotches; front edge of cranium not sharply demarcated; sides of snout, centre of rostral cartilage, and hind margins of pectoral and pelvic fins much paler; eye golden; dorsal fins usually plain. Ventral surface uniformly white; no dark marking at snout tip.

SIZE. To at least 60 cm TL. Males mature at 40–45 cm TL; probably smaller than 22 cm TL at birth.

HABITAT AND BIOLOGY. Eastern Indian Ocean and Western Central Pacific; Western Australia to Papua New Guinea. Demersal on outer continental shelf at depths of 70–200 m. Little known of its biology.

SIMILAR SPECIES. A relatively short triangular snout makes this species distinguishable from all other guitarfishes in the Western Central Pacific.

BOTTLENOSE GUITARFISH

10.30

Rhinobatos schlegelii Müller & Henle, 1841

DD

IDENTIFICATION. Medium-sized guitarfish with a wedge-shaped disc, snout bottle-shaped, anterior nasal flaps moderately developed with inner margin extending well into internasal space (to level of nostril inner corner), body brownish above with or without faint darker blotches, and usually a dark blotch near ventral snout tip (most obvious in young). Disc moderately thick, length 1.3 times its width; anterior margins slightly undulate to almost straight, outer corner of pectoral fins mostly rounded. Snout angle ~50–56°; moderately long and narrowly triangular snout; eye large, length 4.3–5 in preorbital length, 1–1.1 times interorbital space. Rostral ridges separated almost throughout their length, more widely separated posteriorly. Spiracle with 2 weak fleshy folds, inner fold rudimentary. Nostrils oblique, length equal to or slightly longer than internasal space; anterior nasal flaps extending well into but not crossing internasal space. Skin entirely covered with fine denticles; minute thornlets around orbits, above spiracle, and on shoulders; median row of blunt thornlets from nape to first dorsal fin. Tail 1.6–1.7 times longer than disc; large dorsal fins widely spaced, apices acutely rounded. Pectoral-fin radials 61–70. Total vertebral centra 193–200.

COLOUR. Dorsal surface plain pale to medium brown, sometimes also with darker cloud-like blotches; blotches roughly symmetrical. Ventral surface white, with or without prominent tear-shaped dark blotch on snout tip, blotch attenuating with growth (often obscure in adults).

SIZE. Reaches ~100 cm TL. Matures at ~55 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Japan to Taiwan, reports from Philippines and India appear to be other species. Benthic on sandy or muddy bottoms, from coastal to offshore on continental and insular shelves to depths of 200 m. Biology poorly known. Produces litters of 1–14 pups.

SIMILAR SPECIES. Confused with other guitarfishes and erroneously thought to be widespread in the Indo–Pacific. Considered to be the same as a species described from Taiwan, *Rhinobatos formosensis* Norman.

PHILIPPINE GUITARFISH

10.31

Rhinobatos whitei Last, Corrigan & Naylor, 2014

NE

IDENTIFICATION. Medium-sized guitarfish with a broadly wedge-shaped disc, narrow and mildly bottle-shaped snout, nostrils oblique with subcircular anterior aperture, anterior nasal flaps penetrating slightly into internasal space, no thorns, and upper surface blotched with white spots. Disc thin, length 1.2–1.4 times its width; anterior margins of snout concave, outer corner of pectoral fins broadly rounded to abruptly angular. Snout angle ~56–60°, tip bluntly pointed; eye rather large, orbit length 3.9–4.8 in preorbital length, 0.8–1.2 times interorbital space. Rostral ridges well separated. Outer fold of spiracle distinctly larger than inner fold. Tooth rows in upper jaw 65–92. Nostrils rather narrow with 50–53 nasal lamellae, width 1.3–1.6 times internasal width; anterior nasal flap interspace 1–1.1 times internasal width. Skin finely granular, entirely covered with minute denticles; orbits and dorsal mid-line with slightly enlarged denticles but no thorns or thornlets. Tail elongate, 1.2–1.4 times longer than disc; dorsal fins rather widely spaced, interspace 2.6–3.2 times base length of first dorsal fin; apices narrowly rounded to angular. Pectoral-fin radials 63–70. Total vertebral centra 173–179.

COLOUR. Dorsal surface greyish brown, mottled with poorly defined white spots and larger diffuse dusky and orange blotches; snout apex slightly darker than rest of snout; white spots concentrated on central disc and anterior tail, dusky blotches near outer part of disc, orange blotches on central disc and near tail margins. Ventral surface whitish, translucent beside rostral cartilage; disc margins dusky. First dorsal fin weakly blotched anteriorly, darker posteriorly; second dorsal and caudal fins brownish anteriorly, blotched posteriorly; an obvious subcircular blotch over inner margins of both dorsal fins; margin of ventral lobe of caudal fin white.

SIZE. To at least 84 cm TL. Males mature at ~56 cm TL, females slightly larger.

HABITAT AND BIOLOGY. North-West Pacific; Philippine endemic. Demersal on inner insular shelves around the Sulu Sea. Life history unknown.

SIMILAR SPECIES. A bottlenose-shaped head is also typical of the Bottlenose Guitarfish (10.30) from further north in the Western Pacific. These species can be distinguished on body form, squamation, colour pattern, and their mitochondrial DNA.

11

GIANT GUITARFISHES

Family Glaucostegidae

B. Séret, P.R. Last & G.J.P. Naylor

Giant guitarfishes are large to very large rays (most species exceed 2 m TL and some reach 3 m TL or more) with a flattened, spade-like to wedge-shaped disc and a robust, depressed shark-like trunk. Their snout is typically long and its tip varies from being acute or bluntly rounded, to protruding forward as a large bulbous lobe. Eyes typically small and widely separated, spiracles also small with 1–2 variably developed folds. Nostrils are long and almost transverse to oblique with many lamellae (up to 94). They lack a nasal curtain and the anterior nasal flaps are relatively narrow and joined posteriorly to the inner edge of the nostril. Mouth profile is straight. The skin is covered with fine denticles, with small thorns variably confined to a row along mid-line of body, and small patches near eyes, on shoulder and sometimes on snout (often better developed in young than adults). Long-based pelvic fins are positioned laterally, posterior to the disc. Two similarly shaped, upright dorsal fins are well separated, and the first is positioned well behind the tips of the pelvic fins. A small, posteriorly directed caudal fin lacks an obvious ventral lobe typical of wedgefishes (Rhinidae). Colour is plain brownish or greyish dorsally with anterior cranium and rostral cartilage sharply demarcated from a much paler translucent snout. None of the species has spots, stripes or blotches. The undersurface is usually white but the ventral snout appears weakly translucent and its tip can have a black blotch. Giant guitarfishes were only recently recognised as a separate family, with a single genus and 6 valid species. The group was once classified with guitarfishes (Rhinobatidae) but molecular analyses have shown that they are more closely related to sawfishes (Pristidae). Giant guitarfishes are primarily inhabitants of subtropical and tropical inshore continental and insular seas of the Indo–Pacific and Eastern Atlantic, including the Mediterranean Sea. They occur in intertidal habitats and some species have been recorded from fresh and brackish waters. Bottom-dwellers, often resting on soft mud or sandy bottoms, they are also strong swimmers. All species are ovoviviparous. They feed mainly on benthic invertebrates, but their diet includes small benthic fishes. Members of the group are caught in Asia, West Africa and northern Africa (Mediterranean Sea) for their meat, usually as bycatch of artisanal and trawl fisheries. Large fins of adult rays are valuable in international shark-fin markets. Consequently, conservation concerns exist for guitarfishes in some regions due to overfishing.

BLACKCHIN GUITARFISH

11.1

Glaucostegus cemiculus (Geoffroy St Hilaire, 1817)

EN

IDENTIFICATION. Large to very large guitarfish with a plain beige to brownish wedge-shaped disc, long and rather broad triangular snout with a broadly rounded rostral cartilage at its tip, and wide oblique nostrils with a narrow anterior opening. Disc thickened centrally, length 1.2–1.3 times width; anterior margins slightly undulate, often weakly concave before broadly rounded outer corner. Snout moderately acute, angle 59–63°; tip narrowly rounded and not extended forward as a distinct lobe; orbit large, length 5–6 times in preorbital length, 1.5–2 in interorbital space. Rostral ridges narrowly separated posteriorly and almost joined anteriorly. Two prominent fleshy spiracular folds, innermost fold smaller. Tooth rows in upper jaw 62–72. Nostrils large and oblique, length 1.4 in internasal width; ~81 nasal lamellae; anterior nasal flaps confined to anterior margin of nostril. Skin rough, entirely covered with small denticles. Thorns well developed, usually along edge of rostral cartilage and small patches around orbits and above spiracles; 1–3 thorns on each shoulder, persisting in adults; a median row of enlarged thorns extending from nape to first dorsal fin and a few thorns between dorsal fins. Tail long, ~1.5 times disc length; dorsal fins large and rather widely spaced, ~2.1 times base length of first dorsal fin, apices narrowly rounded. Pectoral-fin radials 68–73. Total vertebrae 204–212.

COLOUR. Dorsal side uniform beige to light brown, except for semi-transparent area on snout. Ventral side white; usually with a blackish blotch on tip of snout in young, often fading in adults.

SIZE. Probably reaches 265 cm TL, commonly ~200 cm TL. Males mature at 138–154 cm TL, females at 153–164 cm TL; mature at smaller size (males ~100–110 cm TL, females ~110 cm TL) in Mediterranean Sea. Birth size ~34 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Portugal to Angola, including Mediterranean Sea (possibly now more restricted). Coastal and benthic on sandy and muddy bottoms, from intertidal zone to at least 80 m depth. Feeds mainly on benthic crustaceans and small fishes. Produces litters up to 20 pups, more commonly 6–7 pups.

SIMILAR SPECIES. Distinguished from smaller guitarfishes (Rhinobatidae) of the Eastern Atlantic by its larger size, forwardly positioned first dorsal fin, and a black blotch on its ventral snout tip.

SHARPNOSE GUITARFISH

11.2

Glaucostegus granulatus (Cuvier, 1829)

VU

IDENTIFICATION. Very large, yellowish, brownish or greyish guitarfish with a narrowly wedge-shaped disc, very long and narrow triangular snout with pointed tip, and broad oblique nostrils with narrow anterior opening. Disc thickened centrally, length 1.3–1.4 times width; anterior margin almost straight anteriorly, often weakly concave before broadly rounded outer corner. Snout acute, angle 46–52°; tip bluntly pointed and never protruding forward as distinct lobe; orbit very small in adults, length 9–16 times in preorbital length, 2–3.8 in interorbital space. Rostral ridges almost joined along their entire length; margin of cranium sharply demarcated before eyes. Spiracular folds very short and widely separated. Nostrils about half of mouth width, subequal to internasal width; ~55–59 nasal lamellae; anterior nasal flaps barely penetrating into internasal space, their interspace equal to 2.2–3.2 times length of posterior nasal aperture. Skin rough, densely covered with small denticles; more coarsely granular on dorsal surface than ventrally, enlarged between orbits and in distinct band between nape and first dorsal fin. Pair of large thorns on each shoulder and similar thorns in irregular, median row(s) along mid-line; thorns variable in shape in adults; large thorns in single, well-defined median row, and enlarged along rostrum and around orbits in young. Tail length 1–1.4 times longer than disc; dorsal fins narrowly spaced, interspace 1.3–1.6 times base length of first dorsal fin, apices rounded to bluntly pointed.

COLOUR. Dorsal surface uniformly yellowish brown to greyish, fin margins usually paler; snout sides translucent, sharply demarcated. Ventral surface whitish, snout translucent with white rostral cartilage.

SIZE. To at least 229 cm TL. Mature males (~98 cm TL) may be of a second similar species.

HABITAT AND BIOLOGY. Northern Indian Ocean; Persian Gulf to Myanmar. Primarily benthic, coastal to mid-continental shelf, to at least 120 m depth. Produces 6–10 pups a litter.

SIMILAR SPECIES. Amongst the largest guitarfishes, most common off Sri Lanka and eastern India. A smaller relative, also with a similarly elongate body and long-pointed snout, may exist in the Arabian Sea.

HALAVI GUITARFISH

11.3

Glaucostegus halavi (Forsskål, 1775)

DD

IDENTIFICATION. Large, plain yellowish, brownish or greyish guitarfish with a wedge-shaped disc, wide triangular snout with a broadly rounded cartilage at its tip, and rather broad oblique nostrils with a narrow anterior opening. Disc thickened centrally, length 1.2–1.3 times width; anterior margin almost straight, outer corner broadly rounded. Snout moderately acute, angle ~65°; tip broadly rounded and never extended forward as a distinct lobe; orbit small, length 2.1–2.7 times in interorbital space, 6.3–7.8 in preorbital length in adults (~4.5 in young). Rostral ridges almost joined along their entire length; margin of cranium very sharply demarcated before eyes. Spiracular folds very short and widely separated, outer fold usually largest. Nostrils about 2/3 mouth width, 1.2–1.3 times internasal width; ~61 nasal lamellae; anterior nasal flaps barely penetrating into internasal space, their interspace equal to 2.2–2.4 times length of posterior nasal aperture. Skin rough, covered with small denticles on dorsal surface; denticles best developed between orbits, on rostrum and along central body in young, less obvious in adults. Thorns in median row along body patchy and often forming ridge in adults; in young, enlarged, forming a single, well-defined median row, single large thorn on each shoulder, and those along rostrum and around orbits less well developed. Tail slightly longer than disc; dorsal fins well separated, interspace 1.5–1.9 times base length of first dorsal fin, apices bluntly pointed.

COLOUR. Dorsal side uniformly yellowish to greyish brown, dorsal fins and caudal fins yellowish; sides of snout translucent, sharply demarcated from yellowish rostral shaft and anterior part of cranium. Ventral surface almost entirely white; snout translucent with whitish rostral cartilage.

SIZE. To at least 171 cm TL. Matures at ~83 cm TL; born at ~29 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; Persian Gulf, and Arabian and Red Seas. Benthic, often in very shallow water near the coast and offshore on the continental shelf to depths of at least 100 m. In the Red Sea, produces up to 10 pups a litter, mainly from May to October. Feeds mainly on benthic invertebrates.

SIMILAR SPECIES. Resembles the Giant Guitarfish (11.6) from further east in the Indo–Pacific but is a smaller species with relatively narrow nostrils, and the snout tip is more broadly rounded and never extended forward to form a lobe.

WIDENOSE GUITARFISH

11.4

Glaucostegus obtusus (Müller & Henle, 1841)

VU

IDENTIFICATION. Smallest giant guitarfish with a uniform greyish to brownish body, characteristic shovel-shaped disc, snout short and broadly triangular, and broad oblique nostrils with an oval anterior opening. Disc flattened centrally, length ~1.2 times its width; anterior margin largely convex, outer corner broadly rounded to abruptly angular. Snout relatively obtuse, angle ~80°; tip broadly rounded and not extended forward as a lobe; orbit very small, length ~6.5 times in preorbital length, 2.5–2.7 in interorbital space. Rostral ridges well separated; margin of cranium sharply demarcated before eyes. One small spiracular fold. Nostrils much shorter than mouth, subequal to internasal width; ~50–52 nasal lamellae; anterior nasal flaps barely penetrating into internasal space, their interspace equal to 2.4–2.5 times length of posterior nasal aperture. Skin rough, covered with small denticles, enlarged slightly and more granular on dorsal surface than ventrally. Thorns in irregular row along mid-line of body in young, irregular in shape, often obscure in adults; no obvious patch on each shoulder or greatly enlarged thorns on snout tip and around orbits. Tail long, 1.4–1.6 times disc length. Dorsal fins short, apices rounded; close together, interspace exceeding twice base length of first dorsal fin; well separated from pelvic fins.

COLOUR. Dorsal side uniformly greyish to greyish brown; dorsal fins, and hind margins of pectoral and pelvic fins, paler yellowish; sides of snout whitish to translucent, sharply demarcated from rostral ridges and anterior part of cranium; rostral ridges darker than rest of rostrum. Ventral surface white; anterior snout translucent or white.

SIZE. To 93 cm TL. Males mature at ~48 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; Pakistan to Thailand, eastern limits unclear. Benthic inshore and over inner continental and insular shelves to ~60 m depth. Little known of its biology.

SIMILAR SPECIES. Co-occurs with a larger member of the genus, the Sharpnose Guitarfish (11.2). However, the Widenose Guitarfish is the only species of the genus with a very short and obtuse snout.

CLUBNOSE GUITARFISH

11.5

Glaucostegus thouin (Anonymous, 1798)

VU

IDENTIFICATION. Very large, plain yellowish, brownish or greyish guitarfish with a rather large wedge-shaped disc, long snout with a lobe-like bulbous tip, and very broad oblique nostrils with a narrow anterior opening. Disc thickened centrally, length ~1.4–1.5 times its width; anterior margin almost straight to bulbous snout tip, outer corner broadly rounded. Snout acute, angle ~55°, bulbous tip narrowly oval and protruding well forward; orbit small, length 9–12 times in preorbital length, 2.5–2.9 in interorbital space. Rostral ridges almost joined along their entire length; margin of cranium sharply demarcated before eyes. Spiracular folds very short and widely separated. Nostrils almost as wide as mouth, ~1.9 times internasal width in adults; ~84 nasal lamellae; anterior nasal flaps barely penetrating into internasal space, their interspace equal to ~1.5 times length of posterior nasal aperture. Skin rough, covered with small denticles, larger and more granular on dorsal surface than ventrally. Small thorns in row along mid-line of body and band of small thornlets on interorbit, irregular in shape and absent from each shoulder; thorns relatively larger and median row well defined in juveniles, no enlarged thorns on snout tip or around orbits. Tail ~2 times longer than disc; dorsal fins narrowly spaced, interspace 2–2.5 times base length of first dorsal fin, apices pointed.

COLOUR. Dorsal side mainly uniformly yellowish, sometimes brownish or greyish; most of snout translucent, sharply demarcated from rostral shaft and anterior part of cranium; bulbous snout tip greyish. Ventral surface white, snout apex lacking dark blotch; white rostral shaft strongly demarcated from rest of snout.

SIZE. Reported to reach 300 cm TL, more typically up to 250 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; India to Borneo (Indonesia), also a reliable record from Red Sea. Benthic inshore and across inner continental and insular shelves to ~60 m depth. Little known of its biology.

SIMILAR SPECIES. A characteristic bulbous lobe projecting forward of the snout tip distinguishes it from all other guitarfishes. Limits of its distribution in the Western Indian Ocean need to be established.

GIANT GUITARFISH

11.6

Glaucostegus typus (Bennett, 1830)

VU

IDENTIFICATION. Very large, plain yellowish, brownish or greyish guitarfish with a rather large wedge-shaped disc, long and triangular snout, and very broad semi-oblique nostrils with a narrow anterior opening. Disc thickened centrally, length 1.2–1.3 times its width; anterior margin almost straight, outer corner broadly rounded. Snout moderately acute, angle ~63°; tip narrowly rounded and sometimes extended forward as a short lobe; orbit small, length 6.1–7.8 times in preorbital length, 1.8–2.4 in interorbital space. Rostral ridges almost joined along their entire length; margin of cranium sharply demarcated before eyes. Spiracular folds very short and widely separated. Nostrils almost as wide as mouth, 2.2–2.4 times internasal width in adults; ~94 nasal lamellae; anterior nasal flaps barely penetrating internasal space, their interspace 1.4–1.6 times length of posterior nasal aperture. Skin rough, covered with small denticles, enlarged slightly and more granular on dorsal surface than ventrally. Thorns in row along mid-line of body, irregular in shape; no obvious patch on each shoulder or greatly enlarged thorns on snout tip and around orbits; thorns relatively larger and median row better defined in juveniles. Tail 1.3–1.5 times longer than disc; dorsal fins rather narrowly spaced, interspace slightly more than twice base length of first dorsal fin, apices pointed. Total vertebrae 198–209.

COLOUR. Dorsal side uniformly yellowish to greyish brown, rarely with irregular dark blotches; dorsal fins, and hind margins of pectoral and pelvic fins, paler yellowish; sides of snout whitish or translucent, sharply demarcated from rostral shaft and anterior part of cranium. Ventral surface predominantly white; snout apex usually with dark blotch.

SIZE. To at least 270 cm TL. Matures at 150–180 cm TL; born at 38–40 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; India to East China Sea and Australia. Mostly benthic near the coast but extends across the inner continental and insular shelves to at least 100 m depth. Adults often move to very shallow water near the shore at night, presumably to avoid predators or search for prey; thought to penetrate into freshwaters. Feeds mainly on prawns and crabs.

SIMILAR SPECIES. Formerly known by several scientific names in the Indo–Pacific but these all appear to be a single species. Occurs together with the Clubnose Guitarfish (11.5) but lacks an unusually large bulbous lobe at the snout tip (present in the latter).

12

BANJO RAYS

Family Trygonorrhinidae

P.R. Last & B. Séret

Banjo rays are small to large guitarfishes (reaching 1.5 m TL) with a broad, flattened suboval to wedge-shaped disc, and a rather narrow, depressed trunk. The snout varies from very long and pointed to rather short and broadly rounded. Eyes and spiracles are small to medium-sized, and the spiracle has either 1 well-developed fold or none. Nostrils short and almost horizontal. Anterior nasal flaps are very broad, extending over entire length of nostril, with a long median lobe. A broad nasal curtain is present in one genus (*Trygonorrhina*). Mouth profile is weakly convex to strongly arched. The skin is covered with fine to very coarse denticles, with small to very large thorns in row along mid-line of body, and usually small patches near eyes and on shoulders. Short- to long-based pelvic fins are positioned laterally behind disc. Two tilted dorsal fins are well separated with the first well to slightly behind tips of the pelvic fins. Caudal fin small and lacks a prominent ventral lobe. All species have strong colour patterns consisting of lines, bars, spots and blotches on the dorsal surface, but the cranium and rostral cartilage are not usually sharply demarcated at their edges with the snout. The undersurface is mainly white but black blotches are sometimes present on the snout and posterior disc. Until recently, banjo rays were included in the guitarfishes (Rhinobatidae), but molecular research has shown that members of these groups are distinct from each other. Banjo rays are represented by 3 genera (*Aptychotrema*, *Trygonorrhina* and *Zapteryx*) and 8 valid species. They occur in temperate and tropical seas, primarily inshore on continental shelves but also to ~220 m depth. None of the species occurs in freshwater. Bottom-dwellers, they rest on soft and hard substrates, including seagrasses. Viviparous (aplacental) producing large litters of up to 18 pups. Diet consists primarily of small benthic invertebrates and fishes. Not routinely accessed by the fin trade, the flesh of some species is considered of good quality. Typically caught as bycatch of trawl and set-net fisheries.

KEY TO TRYGONORRHINID GENERA

1. Lobe-like expansion of anterior margin of nostrils joined across isthmus to form nasal curtain (fig. 1); disc oval, snout broadly rounded (fig. 4); 1 large fleshy fold on spiracle (fig. 7); Australia .... *Trygonorrhina* **(2 species; fig. 4, pp. 122–123)**

   Lobe-like expansion of anterior margin of nostrils not connected across isthmus and not forming nasal curtain (figs 2, 3); disc shovel-shaped (fig. 5) or wedge-shaped (fig. 6); small fleshy fold on spiracle present (fig. 9) or absent (fig. 8) 2

2. Disc shovel-shaped or wedge-shaped; snout rather short, length less than 4.5 times eye length (fig. 5); expansions of anterior margin of nostril separated by less than nostril length (fig. 2); upper jaw not or weakly arched (fig. 2); Eastern Pacific and South-West Atlantic .... *Zapteryx* **(3 species; fig. 5, pp. 124–126)**

   Disc wedge-shaped; snout long, triangular and pointed, length exceeding 4.5 times eye length (fig. 6); expansions of anterior margin of nostril separated by about nostril length (fig. 3); upper jaw strongly arched (fig. 3); Australia .... *Aptychotrema* **(3 species; fig. 6, pp. 119–121)**

nasal curtain

fig. 1

fig. 2

fig. 3

oronasal region

fig. 4

fig. 5

fig. 6

large fold

fig. 7

no fold

fig. 8

region of left eye and spiracle

small fold

fig. 9

EASTERN SHOVELNOSE RAY

12.1

Aptychotrema rostrata (Shaw, 1794)

LC

IDENTIFICATION. Medium-sized shovelnose ray with wedge-shaped disc, very long and narrowly triangular snout, narrow nostrils, mouth arched forward strongly, and plain or dark blotched above. Disc thick, length 1.3 times width; anterior margins concave, outer corners mostly angular. Snout acute, angle 55°; orbit small, length 5.7–7.6 in preorbital length, 1–1.1 times interorbital space. Rostral ridges narrowly separated. Spiracle without distinct fleshy folds (often with a small lump). Nostrils nearly transverse, length equal to or slightly shorter than internasal space; no nasal curtain; anterior nasal flaps penetrating only slightly into internasal space; young with relatively broad fleshy lobe on margin of anterior nasal aperture. Skin entirely covered in fine denticles; 2 enlarged thorns on snout tip, 2–3 short preorbital thorns, 1–2 thorns over spiracle, 2 groups of thorns on each shoulder (barely distinguishable in adults), a median row of ~18–20 short, widely spaced thorns on disc and tail, thorns small (sharper in juveniles), slightly compressed. Tail about 1.2 times longer than disc; large dorsal fins widely spaced, apices narrowly rounded. Total vertebrae 171–172.

COLOUR. Dorsal surface uniform greyish brown or with darker blotches over central disc and tail, snout beside dark rostral cartilage distinctly paler; when present, dark or dusky blotches similar in size and usually larger than orbit; no obvious mask around orbit. Ventral surface white with irregular dark flecks; juveniles and some adults with a large black blotch at snout tip and edge of snout black.

SIZE. Reported to reach 120 cm TL, but seldom in excess of 100 cm TL. Males mature at 60–68 cm TL and females at 54–66 cm TL; born at 13–15 cm TL.

HABITAT AND BIOLOGY. South-West Pacific, off eastern Australia. Benthic, mainly inshore and on continental shelf to 220 m depth, but usually shallower than 100 m. Common in estuary mouths and off beaches. Feeds mainly on benthic crustaceans and small fishes. Gives birth, mainly in November and December, to 4–18 pups after 3–5 month gestation.

SIMILAR SPECIES. Once confused with a relative from the Indian Ocean, the Western Shovelnose Ray (12.3). These species differ subtly in colour and snout shape.

SPOTTED SHOVELNOSE RAY

12.2

Aptychotrema timorensis Last, 2004

VU

IDENTIFICATION. Small shovelnose ray with wedge-shaped disc, very long and narrowly triangular snout, narrow nostrils, mouth arched forward strongly, and pattern of white spots on upper disc. Disc thin, length 1.3 times width; anterior margins strongly concave, outer corners broadly rounded. Snout acute, angle ~52°; orbit small, length ~5.2 of preorbital length, exceeding width of interorbital space. Rostral ridges narrowly separated. Spiracle without fleshy folds. Nostrils nearly transverse, slightly narrower than internasal space; no nasal curtain; anterior nasal flaps penetrating only slightly into internasal space. Skin uniformly granular; 2 short thorns before eye; 3–4 thorns near spiracle; ~27 widely spaced thorns along midline of disc and predorsal tail; sometimes 2 enlarged thorns on snout tip and a few on each shoulder; thorns strong, compressed slightly. Tail 1.1 times longer than disc; dorsal fins widely spaced, apices angular. Total vertebrae ~165.

COLOUR. Dorsal surface brownish with widely spaced pale spots, symmetrically arranged; spots dark-edged, smaller than pupil of eye, extending from near orbit to caudal fin; spots sometimes paired on shoulder, above pectoral and pelvic-fin insertions, and near origins of pelvic fins, dorsal fins and free rear tip of pectoral fins. Ventral surface uniformly pale; snout tip pale, lacking dark markings.

SIZE. To at least 58 cm TL; only two mature males known, 48–50 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean, Arafura Sea (northern Australia). Benthic inshore on mid-continental shelf at ~120 m depth. Few specimens ever collected and its biology little known.

SIMILAR SPECIES. Unique within the genus in having white spots and the snout is more narrowly pointed than any other member of the family.

WESTERN SHOVELNOSE RAY

12.3

Aptychotrema vincentiana (Haacke, 1885)

LC

IDENTIFICATION. Medium-sized shovelnose ray with wedge-shaped disc, long and triangular snout, narrow nostrils, mouth arched forward strongly, and yellowish brown with darker brownish or black bars and blotches. Disc thick, length 1.3 times width; anterior margins slightly undulated, outer corners broadly rounded to abruptly angular in adults. Snout acute, angle ~64°; orbit small, length 5.1–5.9 in preorbital length, 1.1–1.2 times interorbital space. Rostral ridges narrowly separated. Spiracle without distinct fleshy folds (often with a small lump). Nostrils nearly transverse, length equal to or slightly shorter than internasal space; no nasal curtain; anterior nasal flaps penetrating only slightly into internasal space; young with narrow fleshy lobe on margin of anterior nasal aperture. Skin uniformly granular; 2–4 short thorns before eye; 1–2 thorns near spiracle; ~18–20 short, widely spaced thorns along mid-line of disc and predorsal tail; sometimes 2 enlarged thorns on snout tip; 2 groups of thorns on each shoulder; thorns small (sharper in juveniles), compressed slightly. Tail 1.3–1.4 times longer than disc; large dorsal fins widely spaced, apices narrowly rounded. Total vertebrae 167–171.

COLOUR. Dorsal surface yellowish brown with dense coverage of darker cloudy blotches (most distinct in adults); usually with dark brown mask around orbit. Small juveniles uniformly yellowish brown or blotched, noticeably paler beside rostral cartilage; blotches similar in size, and larger than orbit. Ventral surface white with irregular dark flecks; snout tip of juveniles and some adults with small black blotch.

SIZE. To at least 84 cm TL, males mature at ~65 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; western and southern Australia. Benthic, on continental shelf from coastal fringe to 125 m depth. Common on sandy beaches and seagrass beds. Feeds mainly on decapod crustaceans and small bony fishes. Females have litters up to 16 young. Juveniles are taken commonly in beach seines and discarded.

SIMILAR SPECIES. Resembles the Eastern Shovelnose Ray (12.1) but differs in its DNA and aspects of its morphology, such as shape and colour of snout. Minor differences exist between northern and southern populations off Western Australia and these need further investigation.

SOUTHERN FIDDLER RAY

12.4

Trygonorrhina dumerilii (Castelnau, 1873)

LC

IDENTIFICATION. Large shovelnose ray with a suboval disc, short and broadly rounded snout, nostrils partly covered with a large nasal curtain, ridges of small thorns on mid-line of disc and shoulders, and an ornate pattern of dark-edged bands and lacking a distinct triangular or diamond-shaped marking behind the interorbital space. Disc depressed, slightly longer than wide; anterior margins convex, outer corners broadly rounded. Snout obtuse, angle ~110°; orbit length 2.8–4.2 in preorbital length, 1.5 or more in interorbital space. Rostral ridges widely separated but not visible. Spiracle with 1 large fleshy fold. Mouth broad, straight to slightly convex. Nasal curtain covering most of nostril, only small anterior aperture visible; flap broader than long, extending to upper jaw. Skin velvety, entirely covered in fine denticles. Enlarged thorn-like denticles in row along dorsal mid-line of disc (~12–16 predorsal) and usually on pair of short ridges on each shoulder (outer ridge longest); 1–2 preorbital, postorbital and spiracular thorns; median thorns on raised mounds, best developed in young. Tail 1.3–1.4 times longer than disc in adults. Dorsal fins large, widely spaced, separated by about length of first dorsal fin or less; apices narrowly rounded.

COLOUR. Dorsal surface usually plain or blotched yellowish to brownish with variable dark-edged bluish grey transverse bands; 3 short parallel stripes radiating posteriorly from eye but not forming a triangular marking; darker bands between and beside eyes; disc and pelvic-fin margins pale; pattern usually more pronounced in young; rarely black with white fins and disc margin. Ventral surface and lateral skin folds uniformly pale.

SIZE. Reported to reach 146 cm TL; males mature at ~70 cm TL and females at 89 cm TL; born at 21–25 cm TL.

HABITAT AND BIOLOGY. Endemic to southern Australia. Benthic, occurs on continental shelf, mainly on soft bottoms and seagrasses, at 5–205 m depths. Feeds on benthic crustaceans, worms, molluscs and small fishes. Gives birth to 2–5 pups.

SIMILAR SPECIES. A black and white colour variant (*Trygonorrhina melaleuca*), which lives in large marine gulfs near Adelaide (South Australia), was recently shown to be a variant of the Southern Fiddler Ray.

EASTERN FIDDLER RAY

12.5

Trygonorrhina fasciata Müller & Henle, 1841

LC

IDENTIFICATION. Large shovelnose ray with a suboval disc, short and broadly rounded snout, nostrils partly covered with a large nasal curtain, ridges of sharp thorns on mid-line of disc and shoulders, and an ornate pattern of dark-edged bands with distinct triangular or diamond-shaped marking behind the interorbital space. Disc depressed, usually slightly longer than wide; anterior margins convex, outer corners broadly rounded. Snout obtuse, angle ~110°; orbit length up to 4 in preorbital length, 1.5 or more in interorbital space. Rostral ridges widely separated but rarely visible. Spiracle with 1 large fleshy fold. Mouth broad, straight to slightly convex. Nasal curtain covering most of nostril, only small anterior aperture visible; flap broader than long, extending to upper jaw. Skin velvety, entirely covered in fine denticles. Enlarged thorn-like denticles in row along dorsal mid-line of disc (~18 predorsal) and usually on pair of short ridges on each shoulder (outer ridge longest); 1–2 preorbital, postorbital and spiracular thorns; median thorns on raised mounds, best developed and with sharp tips in young. Tail 1.3–1.4 times longer than disc in adults. Dorsal fins large, widely spaced, separated by about length of first dorsal fin or slightly less; apices narrowly rounded.

COLOUR. Dorsal surface plain or blotched brownish to greyish with distinctive pattern of transverse lilac bands (with dark brown margins); bands joined to form characteristic dark triangular or diamond-shaped marking behind eyes; dark brown spots often present near disc margin and mid-line anterior to eyes; snout largely pale. Dorsal and caudal fins pale. Ventral surface white.

SIZE. Possibly reaches ~120 cm TL, but seldom exceeds 110 cm TL; born at ~25 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; endemic to eastern Australia. Benthic, mainly inshore and on inner continental shelf to ~100 m depth. Feeds mainly on crabs and shrimps. Produces 2–3 pups.

SIMILAR SPECIES. Similar in appearance to the Southern Fiddler Ray (12.4), but can be distinguished by a characteristic triangular marking on the head behind the eyes (otherwise absent).

SHORTNOSE GUITARFISH

12.6

Zapteryx brevirostris (Müller & Henle, 1841)

VU

IDENTIFICATION. Small guitarfish with a shovel-shaped to suboval disc, bluntly rounded snout, well-developed median and scapular thorns, 1 low skin fold on spiracle, denticles on nape unusually scalloped (edges curved), and usually covered with dark cloudy blotches. Disc much shorter than tail, length ~42% TL. Snout obtuse, rather short, forming an anterior angle of 105–107°; rostral ridges separated; preorbital length 2.1–2.5 times orbit length, 1.9–2.2 times interorbital space. Nostrils narrow, almost horizontal, separated by about their width; innermost edges of anterior nasal flaps extending well into internasal space, separated by about length of anterior aperture of nostril. Skin covered with small dermal denticles of varying shapes above, interspersed with larger conical denticles; much finer and flatter ventrally. Thorns low, bases stellate or scalloped; in 2 rows on each shoulder, small beside eyes, and short row of 4–8 on disc margin at level of nape; regular row of 21–23 domed thorns extending from nape to dorsal fin; no obvious thorns along edges of rostral cartilage. Dorsal fins separated by less than length of first, posterior margins longer than their bases. Clasper of adult male not extending beyond rear tip of first dorsal in adults.

COLOUR. Dorsal surface uniformly greyish brown or yellowish with darker cloudy blotches over disc and on tail at bases of dorsal fins; pale translucent beside rostral cartilage; edges of eye and sides on body distinctly white edged. Ventral surface greyish or white, edges of pectoral and pelvic fins dusky.

SIZE. Attains ~66 cm TL. Males mature at 43–45 cm TL, females at 42–48 cm TL; born at 13–16 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; northern Argentina to southern Brazil, historical records further north to Bahia Province. Benthic inshore over soft bottoms to at least 50 m depth. Gestation lasts about a year, produces litters of 1–8 pups in autumn. Feeds on benthic crustaceans and polychaetes.

SIMILAR SPECIES. Edges of denticle bases on the nape are characteristically curved, rather than being star-shaped as in other members of the genus.

BANDED GUITARFISH

12.7

Zapteryx exasperata (Jordan & Gilbert, 1880)

DD

IDENTIFICATION. Medium to large guitarfish with a shovel-shaped disc, blunt snout, large median and scapular thorns, no dermal folds on spiracles, pair of large black blotches near rear ventral tips of disc, and blotched dorsal pattern with prominent bars around eyes and on snout. Disc shorter than or equal to tail, length 45–50% TL. Snout obtuse, rather short, forming an anterior angle of ~100°; rostral ridges very widely separated throughout their length; preorbital length 3–4 times orbit length, less than 2.5 times interorbital space. Nostrils narrow, almost horizontal and well separated; anterior nasal flaps extending slightly into internasal space. Skin covered with granular denticles above, much finer and indistinct ventrally. Thorns well developed, on low ridges forward of shoulder; regular row of 13–15 thorns extending from nape to dorsal fin, forming spiny tubercles in adults; 2 thorn patches on each shoulder, 2–4 orbital thorns in young, absent in adults; no obvious thorns along edges of rostral cartilage. Dorsal fins rather close together, separated by less than horizontal length of first. Clasper of adult male not extending beyond rear tip of first dorsal in adults.

COLOUR. Dorsal surface yellowish or brownish with darker blotches and bars over disc and tail; prominent black cross bars between orbits and two more on snout, fins blotched. Ventral surface white with large blackish blotch of similar width to mouth at end of each pectoral fin, occasionally with other less regular blotches.

SIZE. Reaches ~97 cm TL. Males mature at 64–70 cm TL, females at 57–77 cm TL; born at 15–18 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; California to northern Mexico, records to Peru probably misidentifications. Benthic, coastal on rocky reefs mainly shallower than 10 m, moves offshore onto soft bottoms in autumn and winter; also reported at depth of 200 m. Large litters of 4–11 pups, born in winter. Adults feed mainly on benthic fishes. Commercially important part of artisanal fisheries.

SIMILAR SPECIES. Has a less angular snout than the Southern Banded Guitarfish (12.8) with two dark transverse bars (otherwise missing).

SOUTHERN BANDED GUITARFISH

12.8

Zapteryx xyster Jordan & Evermann, 1896

DD

IDENTIFICATION. Medium-sized guitarfish with a broad rhombic disc, bluntly pointed snout, large median and scapular thorns, no dermal folds on spiracles, pair of large black blotches near rear ventral tips of disc, and blotched dorsal pattern with small white pectoral ocelli in most stages of growth. Disc shorter than or equal to tail, length 44–50% TL. Snout angular, rather short, forming an anterior angle of ~80°; rostral ridges very widely separated throughout their length; preorbital length 3--4 times orbit length, ~2.7 times interorbital space. Nostrils narrow, almost horizontal and well separated; anterior nasal flaps extending slightly into internasal space. Skin covered with granular dermal denticles above, finer and indistinct ventrally. Thorns well developed, on ridges forward of shoulder; regular row of ~12 thorns extending from nape to dorsal fin, best developed in young; 2 thorn patches on each shoulder, usually 3 orbital thorns; row of smaller thorns along rostral ridges. Dorsal fins well apart, separated by more than horizontal length of first. Clasper extending to end of first dorsal fin or beyond in adults.

COLOUR. Dorsal surface brownish or greyish, with light and dark blotches on disc and tail; usually 2 pairs of pectoral ocelli (on central and posterior fins); ocelli white or yellowish centrally with darker margin, most distinct in young; anterior and inner margins of orbits black. Ventral surface white with pair of large black blotches at rear of each pectoral fin.

SIZE. Reaches 78 cm TL. Males mature at ~47 cm TL, females at ~45 cm TL; born at ~18 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Mazatlan (Mexico) to Peru. Benthic, continental shelf on rocky and sandy bottoms to depths of 150 m. Night feeder, feeds largely on small fishes and prawns. Likely bycatch of gillnet and prawn trawl fisheries.

SIMILAR SPECIES. Occurs in the Eastern Pacific with the Banded Guitarfish (12.7). As the name suggests, the Southern Banded Guitarfish has a more southerly range. It also has a more angular disc and differs subtly in coloration.

13

FANRAYS

Family Platyrhinidae

P.R. Last & B. Séret

Fanrays are small to medium-sized rays (adults from 30–90 cm TL) with a firm body, large, flattened subcircular to shovel-shaped disc and an elongate tapering tail. Pectoral-fin rays, which form the disc, extend forward to snout tip and beyond pelvic-fin origins. Nostrils are positioned close to the mouth, and eyes are narrowly separated and well removed from disc margin. Anterior nasal flaps short and not joined together to form a broad, flap-like nasal curtain. No dermal folds on spiracles. Upper surface with sharp thorns or enlarged denticles on head, shoulders and in row along mid-line of body. Two similar dorsal fins located close together on tail and positioned well behind pelvic fins. Caudal fin elongate and without a distinct lower lobe. Tail slender, abruptly narrower than trunk, lateral folds well developed, and lacking a stinging spine. Colour plain or with transverse stripes, but lacking pectoral ocelli. Ventral surface usually uniformly white. This small ray family includes 2 genera and 4 valid species. Panrays (Zanobatidae) and some banjo rays (Trygonorrhinidae) have a similar body shape but their dorsal fins are positioned relatively further forward on the tail. Fanrays occur in cool-temperate to tropical continental parts of the North-West and Eastern Central Pacific. Demersal in shallow water, living on a variety of soft substrates from nearshore to at least a depth of 137 m. None of the species ventures into freshwater. All species are ovoviviparous. Life histories mostly little known, they feed primarily on small marine invertebrates, including crustaceans, molluscs and worms. Taken mainly as bycatch of net fisheries, and eaten when fresh or salt dried.

KEY TO PLATYRHINID GENERA

Thorns in 1–2 narrowly separated median rows on tail (fig. 1); orbits relatively narrowly separated, snout length 2 or more times interorbital space (fig. 1); Indo–West Pacific .... ***Platyrhina*** **(4 species; fig. 1, pp. 129–132)**

Thorns in 3 widely separated rows on tail (fig. 2); orbits relatively widely separated, snout length less than 1.5 times interorbital space (fig. 2); Eastern Pacific .... ***Platyrhinoidis*** **(1 species; fig. 2, p. 133)**

fig. 1

fig. 2

HYUGA FANRAY

13.1

Platyrhina hyugaensis Iwatsuki, Miyamoto & Nakaya, 2011

NE

IDENTIFICATION. Medium-sized fanray with a shovel-shaped disc, long and slender tail with a single row of hooked thorns, large median and scapular thorns, pair of small thorns preceding main scapular patch, and thorns on orbit, nape and scapular region not broadly encircled by pale pigment. Disc length much shorter than tail. Snout broadly wedge-shaped, rostral ridges probably diverging. Orbits rather narrowly separated, preorbital length ~4 times orbit length, ~2.5 times interorbital space. Nostrils narrow, slightly oblique and well separated; connected to mouth by a wide groove; anterior nasal flaps extending slightly into inter-nasal space. Skin velvety, covered with minute dermal denticles of uniform size and shape, no obvious larger dermal denticles; no cluster of thornlets at snout tip or dense band of smaller thornlets around anterior margin of disc. Thorns well developed, sharp, hooked, not on prominent ridges; regular median row extending from nape to first dorsal fin; 3–6 orbital thorns, 2 symmetrical shoulder patches on each side of disc each with 2 thorns, an additional thorn preceding each innermost patch; no thorns along rostral ridges. Dorsal-fin bases separated by more than 1.4–2 times base length of first. Clasper long, tip well short of first dorsal fin in adult males.

COLOUR. Greyish brown above, darker centrally on disc and tail; fins paler than disc, thorns pale. Ventral side mainly white, outer margins of pectoral and pelvic fins dusky.

SIZE. Attains at least 43 cm TL, males mature from ~20 cm TL.

HABITAT AND BIOLOGY. North-West Pacific, endemic to southern Japan. Narrow-ranging benthic ray, occurring inshore at depths of 8–50 m, but possibly moving deeper offshore in cool winter months.

SIMILAR SPECIES. Only recently discovered. Most similar to the Yellowspotted Fanray (13.4) in general squamation (having only a single thorn row on tail), but thorns around the orbit and central disc are not demarcated by pale blotches (highlighted in the Yellowspotted Fanray).

INDIAN FANRAY

13.2

Platyrhina psomadakisi White & Last, 2016

NE

IDENTIFICATION. Medium-sized fanray with a rough, broadly rounded to shovel-shaped disc, slender tail with a single row of enlarged hooked thorns (2 pairs of lateral rows of thornlets in adults), large median and scapular thorns, and no obvious pair of thorns preceding main scapular patch but upper disc with patches of prickly denticles. Disc length much shorter than tail. Snout short, broadly wedge-shaped (more rounded in young). Orbits narrowly separated, preorbital length 2.6–3.1 times orbit length, 2–2.2 times interorbital space. Nostrils rather narrow, slightly oblique and well separated; skin grooves around mouth; anterior nasal flaps extending slightly into internasal space. Skin velvety in young, covered with additional prickly dermal denticles of varying sizes in adults; greatly enlarged on anterior snout, central disc and in 2, well-spaced paired rows along either side of tail. Thorns well developed, sharp, hooked, not on prominent ridges; regular median row extending from nape to first dorsal fin; 4–6 main orbital thorns, 2 symmetrical shoulder patches on each side of disc (outermost patch with 2 thorns, innermost patch 1 thorn); thornlets on anterior rostral ridges. Dorsal-fin bases separated by 2.1–2.2 times base length of first. Clasper very long, tip extending well past first dorsal-fin origin in adult males.

COLOUR. Greyish brown above; some indistinct dark crossbars on disc, and 5 broad dark saddles on tail; fins and thorn similar to disc. Ventral surface mainly white, sometimes with dusky patches.

SIZE. Attains at least 38 cm TL, largest specimen a mature male.

HABITAT AND BIOLOGY. Northern Indian Ocean; off Myanmar. Recently discovered and known from 4 specimens. Possibly benthic, narrow-ranging and confined to continental shelf at 60–160 m depths. Nothing known of its biology.

SIMILAR SPECIES. Only member of the group occurring in the Indian Ocean. Similar to the Hyuga Fanray but has 1 less thorn on each shoulder (3 rather than 4), and has a rougher disc surface.

CHINESE FANRAY

13.3

Platyrhina sinensis (Bloch & Schneider, 1801)

VU

IDENTIFICATION. Medium-sized fanray with a shovel-shaped disc, long tail with 2–3 prominent rows of hooked thorns, large median and scapular thorns, no pair of thorns preceding main scapular patch, and thorns on head and central disc not broadly encircled by pale pigment. Disc length slightly shorter than tail. Snout long, broadly wedge shaped; rostral ridges diverging. Orbits small, rather narrowly separated, preorbital length ~7 times orbit length, 2.7–3 times interorbital space. Nostrils narrow, slightly oblique and well separated; connected to mouth by a wide groove; anterior nasal flaps extending slightly into internasal space. Skin velvety, covered with mainly minute dermal denticles of uniform size and shape; some larger dermal denticles near sides of anterior disc and tail; no cluster of thornlets at snout tip. Thorns small, sharp, hooked, not on prominent ridges; median row somewhat irregular, forming multiple rows over abdomen and beyond; 4–5 orbital thorns, 2 symmetrical shoulder patches on each side of disc each with 2 thorns, no additional thorns forward of innermost patch; no thorns along rostral ridges. Dorsal-fin bases separated by about base length of first. Clasper short, tip slightly short of first dorsal fin in adult males.

COLOUR. Dark brown to orange brown above, darkest centrally on disc and tail; fins usually paler than disc; thorns whitish or yellowish and contrasted with skin. Ventral side pale, outer margins of pectoral and pelvic fins greyish brown.

SIZE. Attains at least 55 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Vietnam to central China. Benthic in shallow seas. Little is known of its biology.

SIMILAR SPECIES. All members of the genus *Platyrhina* occur in the North-West Pacific, but only the Chinese Fanray has multiple rows of thorns extending along the middle of the tail.

YELLOWSPOTTED FANRAY

13.4

Platyrhina tangi Iwatsuki, Zhang & Nakaya, 2011

NE

IDENTIFICATION. Medium-sized fanray with a shovel-shaped disc, long tail with a single row of hooked thorns, scapular thorns not preceded by pair of small thorns, and large thorns on head and scapular regions broadly encircled by pale pigment. Disc length shorter than tail. Snout broadly wedge-shaped, rostral ridges probably diverging. Orbits rather narrowly separated; in adults preorbital length 4–4.7 times orbit length, 2.1–2.8 times interorbital space. Nostrils narrow, slightly oblique and well separated; connected to mouth by a wide groove; anterior nasal flaps extending slightly into internasal space. Skin covered with minute dermal denticles, some on dorsal surface coarse and enlarged slightly. Thorns short, sharp, not on prominent ridges; 3–5 orbital thorns; 2 symmetrical shoulder patches on each side of disc each with 2 enlarged thorns, up to 11 smaller thornlets adjacent; no thorns along rostral ridges. Dorsal-fin bases separated by more than 0.9–2.1 times base length of first dorsal. Clasper tip falling slightly short of first dorsal fin in adult males.

COLOUR. Dorsal side dark brown to greyish brown, sometimes faintly blotched with a dark median stripe along middle of tail; yellowish borders of anterior thorns strikingly contrasted with rest of disc; fins pale yellowish. Ventral side white, usually covered with irregular greyish blotches; outer margins of pectoral and pelvic fins greyish.

SIZE. Attains at least 64 cm TL, probably to ~70 cm; males typically mature by ~39 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Vietnam to Japan, including Taiwan. Benthic, life history little known. Reaches parturition from August to November.

SIMILAR SPECIES. Most similar to the Hyuga Fanray (13.1) in thorn pattern. Unique within the genus in having large thorns near the orbit and on central disc encircled with yellowish blotches.

THORNBACK FANRAY

13.5

Platyrhinoidis triseriata (Jordan & Gilbert, 1880)

LC

IDENTIFICATION. Large fanray with a broadly oval to subcircular disc, long and stout tail, large scapular thorns, cluster of small thorns at snout tip, 3 widely separated rows of large thorns on tail, and plain coloured dorsal and ventral surfaces. Disc shorter than 3/4 length of tail, widest part closer to pectoral-fin insertion than snout tip. Snout rounded, obtuse, rostral ridges strongly converging. Orbits rather large, widely separated, preorbital length 2.3–2.8 times orbit length, 1.3–1.4 times interorbital space. Nostrils narrow, almost horizontal and well separated; separated from mouth by a diagonal fleshy ridge; edge of anterior nasal flap barely extending into internasal space. Skin velvety on both surfaces. Thorns large, hooked and sharp, particularly in young; median row of ~30 regular thorns extending from nape to first dorsal fin; 1–2 similar lateral rows extending from posterior disc along each side of tail; 2 prominent shoulder patches each with 2–4 thorns, thorns not located on obvious ridges; dense band of smaller thornlets around anterior margin of disc; patch near eye usually dominated by a large preorbital thorn; no thorns along rostral ridges. Dorsal-fin bases separated by about base length of first. Clasper tip falling well short of first dorsal fin in adults.

COLOUR. Dorsal side uniformly dark brownish to yellowish grey; thorns prominent and usually paler than rest of disc. Ventral side white.

SIZE. Attains 91 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; California (USA) to Baja California (Mexico). Benthic on continental shelf, inshore to 135 m depth, but rarely caught at depths below 6 m. Aggregates in shallow bays, lagoons, and off beaches. Pups mainly in August with large litters (up to 15 pups). Feeds on small benthic invertebrates, such as polychaetes, crustaceans and small teleosts.

SIMILAR SPECIES. Only member of this family represented in the Eastern Pacific. It differs in body shape from all other rays found in this region. Skates also have dorsal fins positioned toward the tail tip but their caudal fins are much smaller than in fanrays.

14

PANRAYS

Family Zanobatidae

B. Séret

Small to moderate-sized batoids (to ~60 cm TL) with large pectoral fins forming a heart-shaped or subcircular, flattened disc. Snout short and bluntly angled, and tail slender, depressed and demarcated from disc. Eyes on top of head, just in front of large spiracles. Mouth small, straight and transverse. Numerous small oral teeth, rounded to oval, without cusps on their crowns. Nostrils well developed, just forward of mouth, and connected to it by a groove; nasal flaps (anterior nasal valves) extending onto internasal area and only separated from each other by a short space; nasal lobes (posterior nasal valves) enlarged and cornet-shaped. Body densely covered with tiny dermal denticles giving skin a silky feel, and with clusters of thorns and thornlets on snout, around orbits, on nape and shoulder area, in concentric rows on pectoral fins and in mid-dorsal row on trunk and tail. Pelvic fins are developed and exposed in dorsal view (pectoral posterior margin covering only pelvic-fin origins). Two small, equal-sized dorsal fins on posterior tail, each with rounded apex and convex posterior margin. First dorsal-fin origin well behind free rear tip of pelvic fins. Caudal fin elongate and rounded, without a distinct lower lobe. Dorsal surface brownish or greenish with variegated pattern of dark brown transverse bars and/or blotches, sometimes with some white or black spots. Ventral surface pale, with or without dark posterior pectoral and pelvic-fin margins; sometimes a few dark blotches scattered on belly, and oronasal and gill areas sometimes darker. Panrays are coastal batoids found on the continental shelf off Western Africa (Eastern Atlantic) from shallow waters inshore to ~100 m depth. They are bottom-dwellers, feeding on small invertebrates including crustaceans, worms and molluscs. Ovoviviparous with only the right oviduct functional, they produce litters of 1–4 pups after gestation periods of about 5 months. Caught as bycatch, mainly in bottom trawls and gillnets. Their meat is not utilised because they are extremely difficult to skin, and therefore discarded by fishermen.

MACULATE PANRAY

14.1

Zanobatus maculatus Séret, 2016

NE

IDENTIFICATION. Small panray with a broadly subcircular disc, snout profile broadly rounded, several concentric series of thorns on pectoral fins, dorsal denticles with arrowhead-shaped crowns, and upper surface with dense pattern of dark blotches and small white spots. Nostrils large and connected to mouth by a groove; anterior nasal lobes extending into internasal space, only slightly separated from each other; posterior nasal lobes enlarged and horn-shaped. Mouth small, straight and transverse with thick lips; fleshy knob on upper jaw symphysis. Skin densely and entirely covered with tiny denticles; denticles with arrowhead-shaped crown above, those on ventral surface with flat crowns. Thorns and thornlets numerous on disc, arranged in parallel rows on trunk and in concentric arched rows on pectoral fins; mid-dorsal row of 22–32 thorns from nape to first dorsal fin, 1–4 between dorsal fins and some on caudal peduncle; additional rows of small thornlets may occur on outer pectoral fins. Tail thickened and demarcated from disc; semicircular above in cross-section with ventral surface flat.

COLOUR. Dorsal surface brownish to greenish brown with dense pattern of dark blotches and small white spots; dark blotches numerous, of various sizes, smaller towards disc margins; white spots mostly surrounding blotches. Ventral surface variable, beige, orange or reddish brown with broad dark posterior pectoral- and pelvic-fin margins; oronasal and gill regions often dark, and generally a pair of symmetrical blotches on pelvis; tail beige or orange with some dark blotches on margins.

SIZE. Attains ~36 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic; Gulf of Guinea, from Ivory Coast to Gabon. Coastal benthic. Biology unknown.

SIMILAR SPECIES. This newly described species was once confused with the other member of the family, the larger Striped Panray (14.2), which has smaller thorns on the upper disc and a characteristic pattern of transverse stripes.

STRIPED PANRAY 14.2

Zanobatus schoenleinii (Müller & Henle, 1841)

DD

IDENTIFICATION. Large panray with a flat subcircular disc, snout somewhat angular and obtuse, few series of thorns on pectoral fins, dorsal denticles with ovoid and flattened crowns, and colour pattern on central upper disc dominated by transverse bars. Nostrils large and connected to mouth by a groove; anterior nasal lobes extending onto internasal area and only separated from each other by a short space; posterior nasal lobes enlarged and horn-shaped. Mouth small, straight and transverse with thick lips; fleshy knob on upper jaw symphysis. Skin densely and entirely covered with tiny denticles (feeling silky), their crowns ovoid and flat, without cusps or ornamentations. Thorns and thornlets on disc arranged in series or rows, on snout, around orbits, in arched rows above main cartilages supporting pectoral fin; 1 or 2 concentric arched rows on centre of pectoral fins; a mid-dorsal row from nape to first dorsal fin, some between dorsal fins and on caudal peduncle; additional rows of small thornlets may occur on outer pectoral fins. Tail thickened and demarcated from disc; semicircular above in cross-section with ventral surface flat.

COLOUR. Dorsal surface variable, greyish brown, brownish to greenish with a typical pattern of dark brown blotches and prominent transverse bars on disc; dark cross bars may occur on tail, most evident below dorsal fins; sometimes black spots pepper disc; tips of thorns brown. Ventral surface variable, creamy white to yellowish, with or without dark posterior pectoral- and pelvic-fin margins; sometimes with a few brown blotches scattered on belly; oronasal and gill areas may be darker, orange to reddish brown.

SIZE. Attains ~60 cm TL, commonly 40–50 cm TL; a female of 54 cm TL from Senegal weighed 1.4 kg. Females mature at 37–40 cm TL, males at ~30 cm TL; born at ~19 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Morocco to Angola. Demersal over sandy bottoms in shallow coastal waters of the inner continental shelf to at least 40 m depth, but mainly 10–15 m. Produces litters of 1–4 pups after short gestation. Feeds on benthic invertebrates, mainly shrimps.

SIMILAR SPECIES. Resembles the Maculate Panray (14.1), a smaller species from the Gulf of Guinea with a rougher and more heavily spotted disc.

15

NUMBFISHES

Family Narcinidae

M.R. de Carvalho & P.R. Last

Numbfishes are small to medium-sized rays, typically between 25–75 cm TL; adults of some species are smaller than 25 cm TL. Their disc is circular, oval or shovel-shaped with a depressed head and trunk. Eyes rarely protruding and may be vestigial (concealed from external view in *Benthobatis*). Spiracles are circular to oval, usually with small papillae and elevated rims. The mouth, which is conspicuously small and with a prominent labial cartilage and folds, protrudes forward when suction-feeding on the bottom. Teeth are very small with a minute cusp. The nostrils are small and circular, and the nasal curtain is broad. Large kidney-shaped electric organs are visible through the skin on both sides of the disc. A shark-like tail, which is usually broad based with lateral skin folds or ridges, is about equal to or greater than both the disc length and width. The tail has two moderately large and well-separated dorsal fins, usually subequal in size, with angular to round tips. The caudal fin is usually large and similarly rounded or angular. Numbfishes, like other electric rays, have entirely smooth skin without denticles or thorns. They vary from being drab and uniformly coloured, to having complex patterns of spots, blotches, stripes, bars, ocelli or a distinct combination of these; deepwater species are uniformly purplish brown to blackish brown (*Benthobatis*). The group is poorly known in most regions and several new species have been discovered recently; it presently contains 29 valid species in 4 genera. However, recent DNA analysis suggests that some members of the group belong to other families and more research is needed to investigate these findings. Numbfishes are slow-swimming bottom-dwellers that feed mostly on benthic invertebrates (such as polychaetes). The defensive shocks produced by their electric organs are less intense than those of larger sleeper, coffin or torpedo rays. All species are viviparous without placentae. Numbfishes have a global distribution and occur inshore to well offshore in deep water, but are notably absent from the Mediterranean Sea, Eastern Atlantic, South-East Pacific and from isolated islands of the Pacific Plate. They are often caught in bottom trawls as bycatch but are not consumed as human food.

KEY TO NARCINID GENERA

1. Pelvic fins united to form distinct apron posteriorly (fig. 1); South-East Pacific and South-West Atlantic .... ***Discopyge*** **(2 species; fig. 4, pp. 148–149)**

   Pelvic fins not joined together posteriorly, each joined separately to ventral tail (fig. 2) 2

2. Eyes extremely reduced, concealed by integument, and barely visible as faint spots anterior to spiracles (fig. 6); Western Atlantic and Indo–West Pacific .... ***Benthobatis*** **(4 species; fig. 6, pp. 140–143)**

   Eyes well developed and clearly visible externally (fig. 7) 3

3. Nostrils divided into two separate openings by rigid integument at their mid-length (fig. 3); teeth totally concealed within mouth when closed; Eastern Pacific and Western Atlantic .... ***Diplobatis*** **(4 species; fig. 7, pp. 144–147)**

   Nostril aperture contiguous, not divided into two separate openings by rigid integument at their mid-length (fig. 5); teeth partly visible externally when mouth closed 4

apron

fig. 1

joined separately

pelvic fins (ventral view)

fig. 2

fig. 3

fig. 5

oronasal region

fig. 4

spiracle

fig. 6

eye

spiracle

fig. 7

4. Tail length about equal to disc length or width (fig. 8), apart from *Narcine rierai*; Indo–Pacific and Western Atlantic .... ***Narcine* (15 species; fig. 10, pp. 150–164)**

   Tail much longer than disc length or width (fig. 9); Australia .... ***Narcinops* (5 species; fig. 11, pp. 165–169)**

fig. 8

fig. 9

fig. 10

fig. 11

KREFFT'S BLIND NUMBFISH

15.1

Benthobatis kreffti Rincón, Stehmann & Vooren, 2001

VU

IDENTIFICATION. Small blind numbfish with a thick, oval to shovel-shaped disc, soft body, and plain dusky brown to blackish upper surface. Head and snout flat. Snout large, with vestigial, concealed eyes associated with small, unpigmented pore. Spiracles very small, smooth, and lacking papillae on border. Nasal curtain short and wide; nostrils circular and very small. Shallow circumoral groove. Lower tooth band triangular, slightly narrower than upper band; both bands remain visible when mouth closed; few tooth rows (slightly more than 10 in each band). Tail stout at base and strongly tapering, much longer than disc, and lacking lateral folds or ridges. Pelvic fins with very fleshy, anterior lobe broad; ridge-like posteriorly and fins not joined together at their insertions. Dorsal fins small, fleshy, strongly tilted with rounded apices and short bases; first dorsal originating slightly behind pelvic-fin insertions; separated by a space greater than first dorsal base. Caudal fin very long, much longer than dorsal fins; low with rounded posterior margin.

COLOUR. Upper surface pale brown, dusky brown or blackish brown, slightly darker on dorsal and caudal fins; lighter on pelvic fins and creamy white on claspers. Ventral surface creamy white, dusky on disc and pelvic margins.

SIZE. Reaches 27 cm TL. Males mature at ~15 cm TL, females 20 cm TL; born at ~10 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; southern Brazil (Santa Catarina and Rio Grande do Sul states). Benthic on continental slope at 450–530 m depths. Presumably feeds on bottom invertebrates. Late-term embryos appear to gestate in a combined uterine/cloacal chamber; up to 2 pups are born during each pregnancy. Locally abundant as many individuals have been collected together in a single trawl.

SIMILAR SPECIES. One of the smallest numbfishes and the smallest blind numbfish. In overall appearance, it is most similar to Yang's Blind Numbfish (15.4) from Taiwan, but has a creamy undersurface, longer tail, and smaller dorsal fins.

CARIBBEAN BLIND NUMBFISH

15.2

Benthobatis marcida Bean & Weed, 1909

LC

IDENTIFICATION. Large blind numbfish with a thick, suboval disc (barely longer than wide), soft body, dorsal lobe of caudal fin taller than lower lobe, and largely plain brownish dorsal coloration. Disc widest posterior to its mid-length; head not elevated above disc. Snout long and wide, length about 1/3 of disc length. Eyes apparent externally as very small bulges in large specimens; positioned well anterior to smooth, oblique spiracles that lack distinct rims and papillae. Nasal curtain wide; nostrils small, with slightly elevated rims. Mouth wide, with thick lips and shallow circumoral groove. Lower tooth band triangular, smaller than broader upper band; both bands visible with mouth closed; up to 20 tooth rows in each. Pelvic fins triangular with fleshy, rounded apices. Tail slightly longer than disc, almost half total length; no lateral ridges. Dorsal fins fleshy, fin length about equal to height; upper margins broad, sloping, apices narrowly rounded. First dorsal-fin origin over posterior 2/3 of pelvic fins; interdorsal space shorter than first dorsal-fin base. Distance between second dorsal and caudal fins smaller than second dorsal base length. Caudal fin elongate, less than half tail length (measured from posterior tips of pelvic fins); dorsal margin long and slanted, with weakly pointed apex, taller than convex lower lobe.

COLOUR. Yellowish brown to brownish above, sometimes with small, faint, irregular whitish blotches. Undersurface yellowish white with darker yellowish blotches on disc and pelvic-fin margins, and around mouth.

SIZE. Attains ~50 cm TL. Males mature at ~16 cm TL; size at birth 8–9 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina (USA) to Cuba. Benthic on continental and insular slopes at 250–1000 m depths; adults apparently at greatest depths. An adult female had both ovaries functional with numerous small oocytes of ~2 mm, in thin-walled uteri. Feeds on marine invertebrates.

SIMILAR SPECIES. Largest species of blind numbfish and only member of the genus with the dorsal lobe of the caudal fin larger than the ventral lobe.

INDIAN BLIND NUMBFISH

15.3

Benthobatis moresbyi Alcock, 1898

DD

IDENTIFICATION. Medium-sized to large blind numbfish with a thick oval disc (much longer than wide), soft body, and uniform dark brown to purplish upper surface. Disc widest posterior to its mid-length; head and snout flat. Snout elongate, ~40% of disc length. Eyes not visible externally; positioned anteriorly to inconspicuous spiracles lacking rims and papillae. Nasal curtain wide and short; nostrils small with slightly elevated rims. Mouth wide, with thick lips and shallow circumoral groove. Lower tooth band subtriangular and smaller than broader upper tooth band; both bands visible with mouth closed; up to 19 tooth rows in each jaw. Pelvic fins wide, with fleshy, rounded apices. Tail slightly longer than disc, about half of total length; lateral ridges poorly defined. Dorsal fins with long, fleshy bases; fin length about twice height; apices broad, sloping. First dorsal fin well anterior to posterior tip of pelvic fins, close to mid-pelvic fin; interdorsal space narrower than lengths of dorsal-fin bases. Distance between second dorsal and caudal fins much smaller than length of base of second dorsal fin. Caudal fin elongate, about half of tail length (measured from posterior tips of pelvic fins), and with low upper and lower lobes.

COLOUR. Both dorsal and ventral surfaces uniformly dark brown to purplish black.

SIZE. Reaches at least 40 cm TL. Size at maturity uncertain (probably close to 18 cm TL in males).

HABITAT AND BIOLOGY. Northern Indian Ocean; Arabian Sea, off India, Yemen and Somalia. Benthic on continental slope at 785–1070 m depths. Biology not well known. Based on its oral morphology, probably suction feeds on bottom-dwelling invertebrates.

SIMILAR SPECIES. Second largest member of the genus. It resembles the Caribbean Blind Numbfish (15.2), from which it is easily distinguished by the shapes of the dorsal and caudal fins, and a more uniform darker coloration.

YANG'S BLIND NUMBFISH

15.4

Benthobatis yangi Carvalho, Compagno & Ebert, 2003

VU

IDENTIFICATION. Medium-sized, blind numbfish with a thick oval disc, soft body, and plain purplish or purplish black upper surface coloration. Disc widest at about its mid-length; head and snout flat, snout large. Eyes not visible externally with their position indicated by small pore; pores situated anteriorly to very small, smooth spiracles (without elevated rims and papillae). Nasal curtain short and wide; nostrils very small, circular with slightly elevated rims. Mouth small, with very shallow circumoral groove formed by loose skin. Lower tooth band triangular and upper band small, broad and rounded; both bands visible when mouth closed; up to 15 tooth rows in each jaw. Tail wide at base and tapering, much longer than disc; with very thin lateral ridges. Pelvic fins with wide fleshy apex; very low posteriorly and not united at insertions. Dorsal fins fleshy. First dorsal fin subtriangular, small; second dorsal with longer base, slightly more tilted and with rounded apex; first dorsal originating slightly behind pelvic-fin insertions; dorsal fins separated by a space exceeding first dorsal base length. Dorsal and ventral lobes of caudal fin subequal, both low and long; longer than dorsal fins and with narrowly rounded posterior margins.

COLOUR. Purplish or blackish on both dorsal and ventral surfaces; leading edges of dorsal, pelvic and caudal fins slightly paler. Undersurface creamy, with irregular blotches on pelvic fins and tail. Sensory pores frequently highlighted with darker pigment.

SIZE. Attains at least 37 cm TL, but largest male known 22 cm TL. Sexual maturity for males occurs from 16–19 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; off Taiwan. Benthic on continental slope at ~300 m depth. Feeds mostly on polychaete worms.

SIMILAR SPECIES. Within the genus *Benthobatis*, resembles Krefft's Blind Numbfish (15.1) in physical size and body proportions, but differs in having noticeably longer dorsal and caudal fins, and a ridge-like lateral tail fold (absent in *B. kreffti*).

COLOMBIAN DWARF NUMBFISH

15.5

Diplobatis colombiensis Fechhelm & McEachran, 1984

VU

IDENTIFICATION. Very small numbfish with an oval disc, soft body, and upper surface covered with large dark blotches. Disc widest slightly posterior to mid-length; snout small and elliptical. Eyes very large and bulging, larger than spiracles; spiracles with small, rounded papillae on margins (sometimes missing). Nasal curtain as wide as mouth; nostrils circular, incurrent and excurrent openings separated by stiff tissue. Lips thick, circumoral groove shallow. Tooth bands rounded, concealed when mouth closed; up to 18 rows in upper band. Tail stout at base, wider than interorbital distance; slightly longer than disc length, and with low lateral folds on sides. Pelvic fins broad and long. Claspers short and stout, wider distally, and concealed by pelvic fins. Dorsal fins rounded to rather acute at apex, subequal in size or second dorsal slightly taller; originating slightly behind pelvic-fin insertions; close together, separated by a space smaller than first dorsal base. Caudal fin subtriangular to rounded at apex; slightly larger than dorsal fins and with convex posterior margin.

COLOUR. Light brown to golden dorsal surface, usually with symmetrically arranged brown spots or blotches (varying from 1/4 to an eye diameter in size) on disc, tail, and dorsal and caudal fins (spots altogether lacking in some specimens); snout plain, devoid of darker spots. Ventral surface creamy white.

SIZE. Attains at least 17 cm TL, smallest known specimen 10 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; off Colombia. Benthic on inner continental shelf at 30–100 m depths. Life history unknown.

SIMILAR SPECIES. Similar to other Atlantic *Diplobatis* species, particularly the Venezuelan Dwarf Numbfish (15.6). The Colombian Dwarf Numbfish is distinguished from this ray by a stronger dorsal colour pattern of spots and blotches, and lacking concentric or parallel streaks on the disc and tail.

VENEZUELAN DWARF NUMBFISH

15.6

Diplobatis guamachensis Martín Salazar, 1957

VU

IDENTIFICATION. Very small numbfish with an oval to spade-shaped disc, soft body, and usually with darker longitudinal streaks along disc and tail base. Disc widest posterior to its mid-length. Snout elliptical and smallest among *Diplobatis* species. Eyes large and bulging, larger than spiracles; spiracles usually with small, rounded papillae on margins. Nasal curtain as wide as mouth; nostrils circular, incurrent and excurrent openings separated by stiff tissue. Lips thick, circumoral groove shallow. Tooth bands rounded, concealed when mouth closed; up to 18 rows in upper band. Tail very stout at base, slightly longer than disc length, and with low lateral folds on sides. Pelvic fins broad and long. Claspers short and stout, wider distally, and concealed by pelvic fins. Dorsal fins usually rounded at apex, subequal in size, originating anterior to pelvic-fin insertion, and separated by a space smaller than length of first dorsal base. Caudal fin slightly larger than dorsal fins; rounded at apex and with straight to convex posterior margin.

COLOUR. Light brown to golden brown above with darker pattern of streaks and bands. Markings slender (width up to half eye diameter), arranged longitudinally on outer disc and pelvic fins, and in transverse pattern on tail base; darker spots present on dorsal and caudal fins; streaks on central disc form U-shaped pattern that may extend to snout. Ventral surface uniform creamy white.

SIZE. Known from few specimens, 10–20 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Trinidad to eastern Colombia, most common off Venezuela. Benthic on continental shelf at depths of 30–185 m. Nothing known of its biology.

SIMILAR SPECIES. A distinctive colour pattern distinguishes this species from other members of the genus *Diplobatis*. Even when faded through preservation, it is usually possible to observe the once conspicuous darker streaks on the upper body.

PACIFIC DWARF NUMBFISH 15.7

Diplobatis ommata (Jordan & Gilbert, 1890)

VU

IDENTIFICATION. Small numbfish with an oval to spade-shaped disc, soft body, and highly conspicuous ocellus on centre of upper disc. Disc widest slightly posterior to its mid-length; snout small, elliptical. Eyes large and bulging, larger than spiracles; spiracle margins usually with 7–10 low, rounded papillae. Nasal curtain as wide as mouth, sometimes with small median lobe; nostrils circular, incurrent and excurrent openings separated by stiff tissue. Lips thick, circumoral groove shallow. Tooth bands subtriangular, usually concealed when mouth closed; up to 22 rows in each band. Tail very stout at base, length slightly longer than disc length; with narrow lateral folds on sides. Pelvic fins broad and elongate. Claspers short and stout, straight (not distally expanded), and concealed by pelvic fins. Dorsal fins rounded to rather acute at apex; subequal in size or second dorsal slightly taller; usually originating over pelvic fins; close together, separated by a space smaller than first dorsal base. Caudal fin subtriangular, slightly larger than dorsal fins; with distinct upper corner and straight to rounded posterior margin.

COLOUR. Greyish, brown or purplish brown above, with large (width exceeding eye diameter) circular to elongate blotches on disc, tail and pelvic fins; central ocellus on disc composed of concentric light coloured circles (some incomplete) interspersed with darker concentric streaks; smaller, lighter ocelli sometimes present on pectoral axils and disc; snout region usually uniformly brown. Ventral surface creamy white.

SIZE. Reaches ~25 cm TL; smallest adult males known ~15 cm TL, females ~18 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Baja California to Ecuador. Benthic, relatively common on continental shelf to ~65 m depth. Feeds primarily on crustaceans and polychaetes, as well as other small invertebrates.

SIMILAR SPECIES. Largest species in the genus and only member occurring in the Pacific Ocean. No other *Diplobatis* has a large, highly conspicuous, central ocellus and clasper that does not taper toward its distal tip.

PAINTED DWARF NUMBFISH

15.8

Diplobatis picta Palmer, 1950

VU

IDENTIFICATION. Very small numbfish with an oval to spade-shaped disc, soft body, and strong reticulate colour pattern on upper surface. Disc widest posterior to its mid-length; snout slender and oval. Eyes large and bulging, larger than spiracles; spiracles with small, rounded papillae along margins (sometimes missing). Nasal curtain as wide as mouth; nostrils circular, incurrent and excurrent openings separated by stiff tissue. Lips thick, circumoral groove shallow. Tooth bands rounded, concealed when mouth closed; up to 20 rows in upper band. Tail very stout at base, slightly longer than disc length; with low lateral ridges on sides. Pelvic fins broad and long. Claspers short and stout, wider distally, and concealed by pelvic fins. Dorsal fins rounded to rather acute at apex, subequal in size or second dorsal slightly taller; originating slightly behind pelvic-fin insertions, and separated by space smaller than first dorsal base. Caudal fin subtriangular, larger than dorsal fins, with distinct upper corner, and straight to rounded posterior margin.

COLOUR. Dorsal surface variably light brown to yellowish, with complex pattern of darker spots, blotches and reticulations; snout usually pale, rest of body with irregular to circular dark blotches mixed with smaller dark blotches of varying sizes and often forming complex vermiculate pattern; fewer, scattered and more regular white spots (usually smaller than eye diameter) on disc and tail base. Ventral surface uniform creamy white.

SIZE. Attains at least 18 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; eastern Colombia to Amazon estuary (Brazil). Benthic on continental shelf at 1–130 m depths, most common on soft substrates such as sand and mud. Little known of its life history.

SIMILAR SPECIES. Most similar to other Atlantic and Caribbean *Diplobatis* species, being distinguished largely by subtle details of its colour pattern.

CASTELLO'S APRON NUMBFISH

15.9

Discopyge castelloi Menni, Rincón & García, 2008

NE

IDENTIFICATION. Small to medium-sized numbfish with a large and heart-shaped disc, soft and fleshy body, and uniform brownish or olive green upper surface. Head not protruding much above disc. Snout broadly rounded. Eyes very small, about same size as and closely adjacent to spiracles; spiracles oval with elevated rims and no papillae. Nasal curtain wider than long, with median lobe sometimes covering upper tooth band; nostrils circular and very small. Circumoral groove shallow. Lips slender. Lower tooth band rounded and deep; upper band slightly wider, and both visible when mouth closed; few tooth rows (up to ~10 visible externally in each band). Tail stout at base, longer than disc length; with moderately well-developed lateral folds. Pelvic fins wide but not exceedingly long; with broadly rounded apices and joined together posteriorly forming 'apron'. First dorsal fin upright with rounded apex, originating above pelvic-fin insertion; second dorsal more tilted with narrower apex; fin bases shorter than their heights, separated by a space about equal to first dorsal base. Caudal fin with long, sloping dorsal margin; its upper lobe rather acute, ventral margin slightly convex, posterior border almost straight.

COLOUR. Uniform brown, dusky brown or greenish brown on upper surface; disc and pelvic-fin margins, sides of tail and posterior margins of dorsal and caudal fins whitish. Ventrally creamy white.

SIZE. Females to at least 31 cm TL (males unknown). Smallest known specimens 9–10 cm TL are newborn, still with umbilical scars.

HABITAT AND BIOLOGY. South-West Atlantic; Necochea and Camarones (Argentina). Benthic on inner continental shelf at 35–55 m depths. Rarely captured and nothing known of its life history.

SIMILAR SPECIES. Distinguishable from the Apron Numbfish (15.10) by an unusual heart-shaped (rather than subcircular) disc, considerably shorter pelvic fins and more angular tip of the caudal fin.

APRON NUMBFISH

15.10

Discopyge tschudii Heckel, 1846

NT

IDENTIFICATION. Large numbfish with a large and very thick subcircular disc, soft fleshy body, and uniformly purplish to brownish upper surface. Head barely protruding above disc; snout rounded. Eyes very small, about same size as closely adjacent oval spiracles; spiracles with elevated rims and no papillae. Nasal curtain wider than long, with pronounced median lobe often covering upper tooth band; nostrils circular and very small. Shallow circumoral groove. Lips slender; lower tooth band rounded and deep, upper band wider, and both visible when mouth closed; few tooth rows, up to 20 in each band. Tail moderately stout at base, about equal to disc length; with well-developed, flap-like lateral folds. Pelvic fins wide and long, with broadly rounded apices; joined together at insertion forming conspicuous 'apron'. Dorsal fins fleshy, upright to slightly tilted, with rounded apices; bases shorter than dorsal-fin height, originating above pelvic-fin insertions, and bases close together. Caudal fin with long, sloping dorsal margin, narrowly rounded apex and convex ventral margin.

COLOUR. Light brown, dark olive brown to purplish brown dorsally, sometimes with darker blotches; lateral-line pores and ampullae of Lorenzini conspicuously whitish. Ventral surface uniform creamy white, some specimens with darker, irregular blotches near electric organs.

SIZE. Reaches ~55 cm TL, more commonly to 42 cm TL. Males mature at 23–29 cm TL; newborns 8–9 cm TL. Uniquely, males are larger than females, at least in Argentina.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; widespread off South America from southern Peru to southern Brazil, locally common in Argentina. Benthic on continental shelf at 20–140 m depths. Usually 2–5 pups during each gestation (up to 12 reported from Argentina). Segregates by sex.

SIMILAR SPECIES. Distinguishable from Castello's Apron Numbfish (15.9) by its more circular disc and less pointed caudal-fin apex. Numbfishes of other genera lack a pronounced median lobe on the nasal curtain and joined pelvic-fin insertions (forming an 'apron').

OMAN NUMBFISH

15.11

Narcine atzi Carvalho & Randall, 2003

DD

IDENTIFICATION. Medium-sized numbfish with a large subcircular to broadly oval or heart-shaped disc, soft body, and brownish upper surface covered with semi-regular darker brown spots and blotches. Disc widest slightly posterior to its mid-length; snout broadly rounded anteriorly. Eyes slightly bulging. Spiracles wider than long, with smooth elevated rims (without papillae and frequently flattened). Interspiracular distance much smaller than interorbital distance. Nostrils small and circular, with elevated posterior rim, not divided into two separate openings. Nasal curtain wider than long, straight posteriorly, not covering upper tooth band. Mouth wider than internasal width. Tooth bands with broad, rounded margin; upper band wider than lower band, visible when mouth closed; teeth in ~20 rows in adults. Pelvic fins with wide anterior margins. Dorsal fins large; first dorsal exceeding second in height and base length, and with rounded apex, originating slightly anterior to pelvic-fin insertions; second dorsal more tilted and with narrowly rounded apex. Tail stout at base, length shorter than disc length; lateral folds broad. Caudal fin tall, with rounded apex and posterior margin.

COLOUR. Pale brown to greyish brown above, covered with small dark brown spots or vermicular markings; snout dusky grey or brownish. Ventrally creamy white, sometimes with dusky disc and pelvic-fin margins, and blotches on tail.

SIZE. Attains at least 36 cm TL. Females mature at ~31 cm TL; born at ~11 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; patchy, Gulf of Oman, Bay of Bengal and Andaman Sea. Benthic in shallow coastal waters to ~30 m depths.

SIMILAR SPECIES. Distinguishable from congeners by its unique dorsal markings, tall first dorsal fin (clearly greater than second dorsal), snout shorter than preoral length, and having broadly circular upper and lower tooth bands of similar width.

INDONESIAN NUMBFISH

15.12

Narcine baliensis Carvalho & White, 2016

NE

IDENTIFICATION. Small numbfish with a broadly oval disc (distinctly wider than long), body rather thick and flabby, and dorsal surface densely covered with dark symmetrical pattern of blotches of varying sizes. Disc widest slightly posterior to its mid-length; snout broadly rounded and long. Eyes slightly longer than spiracles, length about equal to spiracle width. Spiracles much wider than long; oblique in relation to eyes, with weakly elevated borders; barely separated from eyes. Nasal curtain much wider than long, with undulate posterior margin; often with short median lobe partly overlapping upper tooth band. Nostrils small and circular, without nasal folds. Mouth wider than internasal distance. Upper tooth band barely wider than lower band, both bands weakly triangular in outline, with up to 26 upper and 21 lower exposed tooth rows. Pelvic fins large. Tail very stout at base and shorter than disc length; lateral folds moderately well developed. Dorsal fins large and subequal in length; first dorsal slightly taller than second, more erect and with broadly rounded apex; second dorsal with more tilted anterior margin, and more pointed apex. First dorsal fin originating over posterior pelvic-fin lobes. Caudal fin with strongly tilted upper lobe and narrowly rounded apex; posterior margin oblique, with broadly rounded lower lobe.

COLOUR. Dorsal surface pale brown, covered with symmetrical pattern of dark brown blotches and smaller spots; markings largely circular or oval (width of largest blotches similar to interorbital space), spots surround blotches; dorsal fins blackish anteriorly, hind margins pale; caudal fin blotchy above and ventral lobe pale. Ventrally largely uniformly white, sometimes with dusky blotches on posterior pelvic fins and disc.

SIZE. Reaches at least 31 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off eastern Indonesia. Benthic, offshore on inner continental shelf at ~60 m depths. Known from few specimens.

SIMILAR SPECIES. Resembles the Shortlip Numbfish (15.15) but has a more complex pattern of larger spots and blotches.

CARIBBEAN NUMBFISH

15.13

Narcine bancroftii (Griffith & Smith, 1834)

CR

IDENTIFICATION. Very large numbfish with an oval to rounded disc (width equal to or slightly wider than long), and variable upper surface coloration usually overlain with large, dark ring-like markings. Disc widest at about 2/3 its length. Snout rounded to broadly angular anteriorly. Eyes large and bulging, larger than spiracles. Spiracles large and subcircular, with thick, elevated rims and papillae; papillae more sparse and pointed in smaller specimens, but knob-like in larger adults and along entire spiracular margin. Nostrils small and circular, nasal flaps large. Nasal curtain short and wide, almost straight posteriorly; partially covering upper tooth band. Mouth width about equal to internasal width. Tooth bands broad, rounded in outline and equal in width. Teeth in up to 26 exposed rows in larger adults; inner and outer rows with long, sharp cusps in large specimens of both sexes. Pelvic fins much wider than long. Claspers cylindrical; projecting well beyond pelvic fins in adults. Dorsal fins very tall, taller than long, with rounded to rather acute apices and upright posterior margins; similar in size, but second dorsal more tilted anteriorly. Tail very stout at base, tapering, but shorter than disc; lateral folds widest in smaller specimens. Caudal fin tall, fan-shaped, with almost straight posterior margin.

COLOUR. Dorsal surface variable, yellowish to orange-brown, covered with darker ring-like blotches and spots; snout usually darker brown. Ventrally uniformly whitish, often with darker irregular marks.

SIZE. Reaches at least 65 cm TL. Males mature at ~23 cm TL; newborns observed at ~9 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina (USA) to Guyana, including Gulf of Mexico and West Indies. Benthic on continental and insular shelves to 35 m depths. Feeds primarily on invertebrates suction-fed off the bottom. Produces up to 16 embryos during each gestation.

SIMILAR SPECIES. Large numbfish resembling the Cortez (15.16) and Lesser Numbfishes (15.14) in size and body proportions. Some populations from the northern border of South America represent an undescribed species.

LESSER NUMBFISH

15.14

Narcine brasiliensis (von Olfers, 1831)

DD

IDENTIFICATION. Large numbfish with a suboval disc usually slightly wider than long, rather firm body, and upper surface usually blotchy with two broad black bars on snout. Disc widest at about 2/3 its length; snout angular to rounded anteriorly. Eyes large and bulging. Spiracles large and subcircular; with elevated rims and isolated, pointed papillae in smaller specimens, but papillae knob-like in adults. Nostrils small and circular, nasal flaps wide. Nasal curtain short and wide, straight posteriorly; partially covering upper tooth band. Mouth about equal to internasal width. Tooth bands with broad, rounded outline and equal width. Teeth in up to 35 exposed rows in larger adults; inner rows with wide and sharp crowns in both sexes. Pelvic fins much wider than long. Claspers cylindrical, projecting well beyond pelvic fins in larger adults. Dorsal fins very tall, taller than long, with narrowly rounded to rather acute apices and upright posterior margins; similar in size, but second dorsal slightly taller and with more tilted anterior margins. Tail very stout at base, about as long as disc; lateral folds widest in smaller specimens. Caudal fin tall, fan-shaped, with narrowly rounded to rather acute dorsal corners, and rounded ventral and posterior margins.

COLOUR. Uniformly brownish above or usually with distinct darker brown blotches over disc and tail; pair broad black bars on snout. Ventrally creamy white, usually with dusky posterior margins on disc and pelvic fins.

SIZE. Reaches ~45 cm TL. Both sexes mature by 27 cm TL; newborns ~11 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; Brazil to northern Argentina. Benthic on continental shelf, mainly inshore; aggregates in shallow waters (10–20 m deep) in summer and autumn months, dispersing to deeper waters in winter. Litters average ~4 pups.

SIMILAR SPECIES. Along with the Caribbean (15.13) and Cortez Numbfishes (15.16), forms a species-group of large-bodied Numbfishes. They share many features (e.g. papillate spiracles, similar body proportions). The Lesser Numbfish resembles the Caribbean Numbfish but has more tooth rows and a slightly different colour pattern.

SHORTLIP NUMBFISH

15.15

Narcine brevilabiata Bessednov, 1966

VU

IDENTIFICATION. Small to medium-sized numbfish with a broadly oval disc (usually slightly wider than long), rather firm body, and dorsal surface densely covered with large symmetrical blotches and ocellate spots. Disc widest slightly posterior to its mid-length; snout broad, oval and long. Eyes slightly longer than spiracles, about equal to spiracle width. Spiracles slightly oblique in relation to eyes with weakly elevated borders; often separated from eyes by small interspace. Nasal curtain wider than long, usually with straight posterior margin (some specimens with small median lobe overlapping upper tooth band). Nostrils large and circular, with well-developed nasal folds. Mouth wider than internasal distance. Upper tooth band wider than lower band; both bands triangular in outline; few tooth rows exposed (up to 14 upper and 10 lower rows). Pelvic fins medium-sized. Tail stout at base and shorter than disc length; lateral folds rather well developed. Dorsal fins large and subequal in size; first dorsal slightly taller than second, more erect and with more rounded apex; second dorsal with tilted anterior margin, and pointed apex. First dorsal fin originating over posterior pelvic-fin lobes. Caudal fin with tilted upper lobe and narrowly rounded apex; posterior margin slightly oblique with rounded lower lobe.

COLOUR. Light brown to yellowish above, covered with large and very small dark brown spots; largest spots fewer in number and slightly smaller than interorbital space; smaller spots numerous and smaller than eye; spots smaller on snout and dorsal and caudal fins. Ventrally uniformly pale, with greyish blotches on posterior pelvic fins and disc.

SIZE. Reaches 32 cm TL, usually smaller to 25 cm TL; newborns ~8 cm TL.

HABITAT AND BIOLOGY. Indian Ocean and North-West Pacific; Bay of Bengal to Taiwan, possibly including Philippines and probably more widely distributed. Benthic, offshore on inner continental shelf at 20–70 m depths.

SIMILAR SPECIES. Resembles the Indonesian Numbfish (15.12), differing from it in dorsal coloration and body proportions.

CORTEZ NUMBFISH

15.16

Narcine entemedor Jordan & Starks, 1895

DD

IDENTIFICATION. Very large numbfish with an oval disc (usually slightly longer than wide), and upper surface with 4–5 prominent ocelli in young that often fade in adults. Disc widest at about 2/3 its length; snout angular to rounded anteriorly. Eyes large and bulging. Spiracles large and subcircular with elevated rims and papillae; papillae isolated and pointed in smaller specimens, but knob-like in adults. Nostrils small and circular, nasal flaps enlarged posteriorly. Nasal curtain short and wide, straight posteriorly, partially covering upper tooth band. Mouth width about equal to internasal width. Tooth bands with broad, rounded outlines and equal width. Teeth in up to 30 exposed rows in adults; inner rows with wide crowns. Pelvic fins much wider than long. Claspers cylindrical, projecting well beyond pelvic fins in adults. Dorsal fins very tall, taller than long, with narrowly rounded to rather acute apices and upright posterior margins; similar in size, but second dorsal with more tilted anterior margin. Tail very stout at base, about as long as disc; lateral folds wider in smaller specimens. Caudal fin tall, with narrowly rounded to rather acute dorsal and ventral corners, and rounded posterior margin.

COLOUR. Yellowish, olive brown or dark purplish brown; young specimens from northern parts of range with 4–5 ocelli on central; ocelli with darker centres and paler outer rings, usually fading into irregular blotches or absent in adults. Ventrally creamy white.

SIZE. Reaches 75 cm TL. Males mature at ~36 cm TL; newborns ~11 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Baja California (Mexico) to northern Peru. Benthic on continental and insular shelves in shallow water at depths to 100 m; reported to penetrate estuaries at Mazatlán (Mexico). Produces litters of up to 15 pups.

SIMILAR SPECIES. Perhaps the largest numbfish. Similar to the Caribbean (15.13) and Lesser Numbfishes (15.14) in body proportions and having papillate spiracles. These other numbfishes do not have an ocellate colour pattern.

MADAGASCAR NUMBFISH

15.17

Narcine insolita Carvalho, Compagno & Séret, 2002

DD

IDENTIFICATION. Medium-sized numbfish with an oval to heart-shaped disc (widest just posterior to its mid-length), body fleshy and very thick at margins, very large first dorsal fin, and upper surface with brown to reddish brown reticulations and/or blotches. Snout markedly oval anteriorly, but not excessively broad or long. Eyes very large and bulging. Spiracles large, circular to slightly oblique, with all of rim raised; interspiracular distance smaller than interorbital distance. Nostrils circular and small, with low posterior nasal flaps; nostril not divided into two separate openings. Nasal curtain short and wide; posterior edge straight, not covering upper tooth band. Mouth width equal to internasal width. Tooth bands broadly rounded and equal in width. Teeth in up to 24 rows in adults; inner rows with wide crown, long central cusp and smaller lateral cusps. Pelvic fins much wider than long. Claspers slender and flat, distal tip square. Dorsal fins very tall, taller than long, with rounded posterior margins; first dorsal fin much larger than second in height and base length, with rounded apex and its origin near pelvic mid-length; second dorsal about half as broad as first, more tilted and with more narrowly rounded apex. Tail stout at base, longer than disc; lateral folds very wide. Caudal fin large, with well-developed upper and lower lobes, narrowly rounded apex and rounded posterior margin.

COLOUR. Yellowish brown above, with dark brown to reddish brown reticulations and/or blotches (usually larger than eye-diameter) on disc margins and anterior margin of snout. Ventrally uniformly creamy white.

SIZE. Attains ~36 cm TL. Males mature at ~27 cm TL; newborns found at ~14 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; off Madagascar. Benthic, appears to prefer muddy substrates on outer continental shelf at 150–175 m depths.

SIMILAR SPECIES. Similar to the Bigeye Numbfish (15.21) but has a lighter dorsal colour and taller dorsal fins.

LEOPARD NUMBFISH 15.18

Narcine leoparda Carvalho, 2001

NT

IDENTIFICATION. Small numbfish with a rounded disc (about as wide as long) widest just posterior to its mid-length, and unique dorsal coloration of pale ocelli resembling leopard spots. Snout broadly rounded anteriorly. Spiracles and eyes close together; spiracles circular to oval, with low rims lacking papillae. Eyes rather small, about as long as spiracles. Nasal curtain wider than long, with more or less straight posterior margin (small central lobe sometimes present). Nostrils small and circular. Mouth about as wide as distance between nostrils. Upper and lower tooth bands equal in width and circular in outline; externally visible teeth in ~16 upper and ~12 lower rows. Pelvic fins wider than long. Tail short, length much shorter than either disc width or length; lateral fold reduced to slender keel. Dorsal fins similar, with rounded apices and small free lobes posteriorly. Second dorsal fin slightly taller than first and with slightly longer base. Caudal fin with angular apex, somewhat tall and not elongate, with straight or convex posterior margin; lengths of dorsal and ventral lobes about equal.

COLOUR. Brown, rusty or purplish brown above, with broad covering of whitish spots or ocelli; ocelli a creamy white spot surrounded by darker brown ring. Embryos and newborns have adult coloration (with white ocelli and spots). Ventrally uniformly creamy white; adults sometimes with posterior disc and pelvic fins with brownish margins.

SIZE. Reaches ~30 cm TL. Males mature at ~18 cm TL, females ~20 cm TL; newborns ~13 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Colombia (Valle del Cauca to Nariño). Benthic in shallow water on continental shelf to 35 m depths. Fecundity low, with only 2–3 embryos each gestation.

SIMILAR SPECIES. Close to the Vermiculate Numbfish (15.25), but distinguishable by its unique colour pattern of spots and ocelli.

CHINESE NUMBFISH

15.19

Narcine lingula Richardson, 1846

DD

IDENTIFICATION. Medium-sized numbfish with a large, oval to rounded or heart-shaped disc (usually slightly wider than long) with rounded to angular lateral corners and widest near mid-disc, and dense pattern of large dark spots. Snout broad, rounded to suboval anteriorly. Eyes and spiracles subequal in size, not enlarged. Spiracles subcircular, with thin, elevated rims; sometimes oblique in relation to eyes. Nostrils circular, medium-sized, nasal flaps moderate. Nasal curtain short and wide with faint median lobe; partially covering upper tooth band. Mouth about equal to internasal width. Tooth bands broad, rounded in outline and equal in width; teeth in up to 22 exposed rows in adults. Pelvic fins wider than long, with broadly convex posterior margins in fresh specimens. Claspers slender, flattened in adult males. Dorsal fins medium-sized, with rounded apices and rounded to straight posterior margins; similar in size, second dorsal more tilted anteriorly. Tail moderately stout at base, shorter than disc length; lateral folds not especially wide. Caudal fin not especially tall, with slanted upper lobe, narrowly rounded apex, rounded ventral margin, and almost straight posterior margin.

COLOUR. Dorsal surface pale brownish, densely covered with large darker brown, oval, circular or crescent-shaped spots of varying shapes and sizes; markings present on body and fins. Ventrally creamy white, frequently with darker disc margins.

SIZE. Attains 35 cm TL, more commonly to ~30 cm TL. Males mature at ~24 cm TL; newborns ~11 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; Pakistan to East China Sea (Shanghai), including Taiwan and possibly Japan and Philippines. Benthic, common inshore in shallow water near coast. Life history largely unknown.

SIMILAR SPECIES. Very similar to another spotted species of the genus *Narcine*, the Smallspot Numbfish (15.20) with which it overlaps. These species can be distinguished by details of their nostril and mouth proportions, and dorsal coloration.

SMALLSPOT NUMBFISH

15.20

Narcine maculata (Shaw, 1804)

DD

IDENTIFICATION. Medium-sized numbfish with a large, broadly oval to heart-shaped disc (usually slightly wider than long) with rounded to angular lateral corners, widest at about mid-disc, and dense coverage of medium-sized dark spots and blotches. Snout broad, rounded anteriorly. Eyes medium-sized, barely longer than spiracles. Spiracles subcircular with thin, elevated rims; sometimes oblique in relation to eyes. Nostrils large and circular, nasal flaps well developed. Distance between outer margins of nostrils slightly exceeding mouth width. Nasal curtain very short, wide, with faint median lobe; partially covering upper tooth band. Tooth bands broad, rounded in outline and subequal in width; exposed teeth in up to 22 rows in adults. Pelvic fins wide, with broadly convex posterior margins in fresh specimens. Claspers slender, flattened in adult males. Dorsal fins medium-sized, with rounded apices and usually straight posterior margins; second dorsal with slightly longer base than first, more tilted anteriorly. Tail moderately stout at base, shorter than disc length; lateral folds narrow. Caudal fin large, dorsal lobe taller and more slanted than lower lobe; apex narrowly rounded to angular, rounded ventral margin, and convex posterior margin.

COLOUR. Brownish with darker reddish brown to blackish brown spots. Markings covering dorsal, pelvic and caudal fins; varying in both shape and size, but generally circular to ovoid, close in size to eye diameter (occasionally smaller) or slightly larger (anterior to first dorsal fin on tail base); some spots merge into elongate blotches. Ventrally creamy white, sometimes with darker disc margins.

SIZE. Reaches ~40 cm TL, usually smaller to 35 cm TL. Males mature smaller than 28 cm TL; newborn at ~13 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; Sri Lanka to south-west China (Hong Kong), including Taiwan and Philippines. Benthic in shallow water. Biology little known.

SIMILAR SPECIES. Sympatric with the Chinese Numbfish (15.19), being distinguished largely by morphology of the oronasal region.

BIGEYE NUMBFISH

15.21

Narcine oculifera Carvalho, Compagno & Mee, 2001

DD

IDENTIFICATION. Medium-sized numbfish with a oval to heart-shaped disc, widest just posterior to its mid-length, body fleshy with thick margins, and upper surface with brownish to reddish brown reticulate pattern (most visible in live specimens). Snout rounded anteriorly but not especially wide. Eyes very large and bulging. Spiracles large and circular; wide elevated rims completely surrounding spiracular opening. Interspiracular distance much smaller than interorbital distance. Nostrils small, circular to oval, with low posterior nasal flaps; not divided into two separate openings. Nasal curtain short and wide, margin straight posteriorly; not covering upper tooth band. Mouth width equal to internasal width. Tooth bands with broad, rounded outlines and subequal width. Teeth in 30 rows in adult; inner teeth with wide crown, sharp central cusp and smaller blunt lateral cusps. Pelvic fins much wider than long. Claspers slender and flat, distal tip somewhat square. Dorsal fins very tall, taller than long, with narrowly rounded apices and rounded posterior margins; first dorsal slightly larger than second in height and base length, originating near pelvic mid-length; second dorsal more tilted. Tail stout at base, longer than disc; lateral folds very wide. Caudal fin tall, with narrowly rounded apex and convex posterior margin.

COLOUR. Dorsal surface with irregular pale brown to reddish brown reticulate pattern delimited by pale oval, kidney-shaped and circular blotches of variable sizes; dorsal and caudal fins white-spotted and with whitish posterior margins. Ventrally whitish, with darker disc and pelvic-fin margins.

SIZE. Reaches 35 cm TL. Females adult at 32 cm TL, but probably mature earlier; males mature at ~24 cm TL. Newborns at ~12 cm TL.

HABITAT AND BIOLOGY. North-West Indian Ocean; northern Somalia and Oman. Known from few specimens, but reported to be locally common near Muscat. Benthic on rocky and sandy bottoms in shallow coastal waters to ~25 m deep.

SIMILAR SPECIES. Resembles the Madagascar Numbfish (15.17) in coloration but has much taller dorsal fins.

TONKIN NUMBFISH

15.22

Narcine prodorsalis Bessednov, 1966

DD

IDENTIFICATION. Medium-sized numbfish with a large oval to heart-shaped disc (usually slightly wider than long) with rounded to angular lateral corners, disc widest at about its mid-length, and dorsal surface densely covered with irregular dark spots. Snout broad, rounded anteriorly. Eyes small, usually smaller than spiracles. Spiracles subcircular with thin, elevated rims; sometimes oblique in relation to eyes. Nostrils rather small and circular, nasal flaps well developed. Nasal curtain very short, wide, partially covering upper tooth band. Tooth bands broad, rounded in outline and subequal in width; exposed teeth in up to 22 rows in adults. Pelvic fins moderately broad, triangular. Dorsal fins medium-sized, with rounded apices, and straight or rounded posterior margins; second dorsal with slightly longer base than first, more tilted anteriorly. Tail moderately stout at base, slightly longer than disc length; lateral folds narrow. Caudal fin not especially tall with slanted upper lobe; narrowly rounded apex, broadly rounded ventral margin, and almost straight posterior margin.

COLOUR. Dorsal surface greyish to light brown, covered with dark brown to blackish brown irregular spots (over disc, pelvic, dorsal and caudal fins); spots varying in shape (narrowly rounded to rounded) and size, but usually about eye-size on disc, and slightly larger on tail. Ventral surface uniform creamy white.

SIZE. Reaches ~35 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; India to China (South China Sea), Indonesia and possibly Philippines. Likely to be more widespread on continental shelf of South-East Asia. Benthic in shallow water to ~40 m depth. Life history unknown.

SIMILAR SPECIES. Resembles the Chinese Numbfish (15.19) and the Smallspot Numbfish (15.20), but separated tentatively by its colour pattern consisting of relatively smaller spots. May prove to be a synonym of the Smallspot Numbfish (15.20).

MOZAMBIQUE NUMBFISH

15.23

Narcine rierai (Lloris & Rucabado, 1991)

DD

IDENTIFICATION. Small numbfish with a distinctive, fleshy shovel-shaped disc (longer than wide), widest at its posterior third, and plain coloured upper surface. Snout short, oval to subtriangular. Eyes large, bulging, larger than spiracles. Spiracles elliptical, with smooth borders. Nasal curtain longer than wide, slightly tapering and with median lobe. Nostrils slit-like, with large nasal flaps. Mouth small, slightly wider than internasal distance. Upper tooth band slightly subequal to lower band, more triangular; exposed teeth in up to 16 rows in adults. Pelvic fins wider than long, with thick corners; lacking free posterior lobe. Tail tapering from near mid-length rather than base, slender and almost circular in cross-section; tail much longer than disc length or width; lateral folds ridge-like. Dorsal fins small, widely separated; subequal in height and length, with narrowly rounded to rather acute apices. First dorsal fin originating posteriorly to pelvic-fin insertion. Caudal fin low and long, with strongly slanted upper lobe and narrowly rounded to rather acute apex; posterior margin convex to more or less straight, ventral lobe sometimes larger than dorsal lobe.

COLOUR. Dorsal surface uniform golden brown to reddish brown; sometimes slightly darker over eyes, on mid-disc and bases of dorsal fins, and at pectoral-fin axils. Ventrally uniformly creamy white.

SIZE. Reaches 30 cm TL. Matures at ~26 cm TL, born at ~9 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; Somalia to Mozambique, and probably to South Africa. Benthic on outer continental shelf and upper slope at 170–500 m depths. Two mid-term embryos (each just over 7 cm) found in right uterus of large female, indicating low fecundity.

SIMILAR SPECIES. Only numbfish found off Central East Africa. It resembles Australian numbfishes (genus *Narcinops*) in having a small, shovel-shaped disc and very elongate tail. However, the Mozambique Numbfish differs in having more slender, subtriangular tooth bands and the nasal curtain longer than wide.

BROWN NUMBFISH

15.24

Narcine timlei (Bloch & Schneider, 1801)

DD

IDENTIFICATION. Small numbfish, with an oval or subtrapezoidal disc (widest close to mid-length), and plain coloured upper surface. Snout long and broad, evenly rounded anteriorly. Eyes small, not protruding, usually smaller than spiracles; eyes and spiracles joined together. Spiracles rounded, with elevated, smooth borders. Nasal curtain short, much wider than long; sometimes with subtriangular median lobe. Mouth small, slightly wider than internasal distance; upper tooth band partially covered by median lobe of nasal curtain. Tooth bands wide, about half of mouth width; exposed teeth in up to 25 rows in adults. Nostrils large and circular, with small folds posteriorly. Pelvic fins broad, much wider than long. Tail stout at base, its length slightly shorter than disc length; lateral folds low. Dorsal fins small, subequal in height and length, or second dorsal slightly taller than first; first dorsal with broad and rounded apex, originating slightly posterior to pelvic fin insertion; second dorsal with a more tilted anterior margin and slightly more pointed apex. Caudal fin with slanted upper lobe and narrowly rounded apex; posterior margin convex to more or less straight.

COLOUR. Dorsally uniform yellowish, brownish or purplish brown, without any elaborate markings; posterior margins of dorsal fins, lateral tail region and posterior pelvic borders whitish. Creamy white ventral coloration.

SIZE. Smallest species of *Narcine*, reaches ~24 cm TL. Males mature at ~14 cm TL; newborns ~6 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; Arabian Sea (Pakistan) to South-East Asia (Thailand, Malaysia, Singapore, Indonesia, Vietnam, and southern China). Widespread, benthic, and locally abundant in shallow water. Gravid females produce 2–3 pups during each gestation.

SIMILAR SPECIES. Distinguishable from all other *Narcine* species by its small maximum size, very small eyes, and plain coloration. Frequently used species names, *Narcine indica* Henle and *N. brunnea* Annandale, are synonyms.

VERMICULATE NUMBFISH 15.25

Narcine vermiculata Breder, 1928

NT

IDENTIFICATION. Small numbfish with a rounded disc (length equal to width or slightly longer) widest just posterior to its mid-length, and unique coloration consisting of a reddish brown dorsal surface covered with white stripes, narrow blotches and/or reticulations. Snout broadly rounded anteriorly. Eyes noticeably smaller than spiracles. Spiracles oval to rounded, with raised rims but no papillae. Nasal curtain wider than long; faint central lobe usually present on posterior margin. Nostrils small and circular. Mouth slightly wider than distance between nostrils. Upper and lower tooth bands subequal in width and circular in outline; exposed teeth in ~20 rows in large specimens. Pelvic fins wider than long. Tail short, length shorter than either disc width or length; lateral folds low. Dorsal fins similar in shape, with rounded apices and small free posterior lobe; second dorsal slightly taller than first, but fin lengths about equal. Caudal fin with angular apex, rather tall and not elongate; posterior margin straight or convex, dorsal lobe slightly longer than ventral lobe.

COLOUR. Brownish to reddish brown, with irregular white perpendicular stripes, blotches and/or reticulations; markings less apparent on snout but extending posteriorly on tail and fins (caudal fin usually blotchy). Ventral surface creamy white.

SIZE. Reaches at least 30 cm TL. Males mature at ~19 cm TL; newborns ~6 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Gulf of California (Mexico) to Costa Rica. Benthic on soft bottoms of continental shelf, inshore to 100 m depths (but mostly shallower than 40 m).

SIMILAR SPECIES. Probably closely related to the Leopard Numbfish (15.18), also from the Eastern Pacific, with which it shares many features. However, the markings of the Vermiculate Numbfish are more striped rather than spotted.

WEST AUSTRALIAN NUMBFISH

15.26

Narcinops lasti (Carvalho & Séret, 2002)

LC

IDENTIFICATION. Medium-sized numbfish with a suboval to shovel-shaped disc, medium-sized snout, nasal curtain wider than long, tail much longer than disc, low lateral ridge on each side of tail (lacking a soft fold), and plain yellowish upper surface. Disc length subequal to width, typically broadest toward insertion of pectoral fin; margin broadly rounded anteriorly then weakly concave before apex. Head region rather small, eyes and spiracles slightly separated. Eyes medium-sized. Spiracles smooth, lacking papillae on border; smaller than eyes. Nostrils circular with elevated rims, not divided into 2 separate openings. Nasal curtain posterior margin with 3 obvious lobes. Upper tooth band wider than lower band; both bands visible when mouth closed and circular in outline; exposed teeth in up to 20 rows. Pelvic fins long-based and narrow, not joined together posteriorly. Dorsal fins with narrowly rounded apices, much smaller than caudal fin; usually originating slightly behind pelvic-fin free rear tips, typically separated by more than base of first dorsal. Tail not broad and subcircular at base, longer than disc length or width, with low ridge-like lateral folds. Caudal fin rather long, low, with rounded posterior and ventral margins.

COLOUR. Upper surface uniformly pale yellowish, somewhat lighter over pelvic-fin margins and lateral bases of tail; dorsal and caudal fins translucent. Ventral surface uniformly creamy or white.

SIZE. Attains at least 37 cm TL, matures at ~24 cm TL; born at ~7–8 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Australia and eastern Indonesia. Benthic on outer continental shelf and upper slope at 180–320 m depths. Biology largely unknown.

SIMILAR SPECIES. Very closely resembles the East Australian Numbfish (15.27) and Tasmanian Numbfish (15.29), particularly in body shape, but the West Australian Numbfish has a lighter dorsal coloration and slightly larger disc proportions.

EAST AUSTRALIAN NUMBFISH 15.27

Narcinops nelsoni (Carvalho, 2008)

LC

IDENTIFICATION. Medium-sized numbfish with a shovel-shaped disc, moderately elongate snout, nasal curtain wider than long, tail much longer than disc, low lateral ridge on each side of tail (lacking a soft fold), and plain pale brownish upper surface. Disc usually longer than wide, typically broadest toward insertion of pectoral fin; margin broadly rounded anteriorly then concave before apex. Head region rather small. Eyes medium-sized. Spiracles smooth, lacking papillae on border; smaller than eyes. Nostrils circular with elevated rims, not divided into 2 separate openings. Nasal curtain posterior margin sometimes with 3 obvious lobes. Upper tooth band wider than lower band, both visible when mouth closed; exposed teeth in up to 16 rows. Pelvic fins long based and narrow, not joined together posteriorly. Dorsal fins with narrowly rounded apices, much smaller than caudal fin; originating well behind pelvic-fin free rear tips, separated by much more than base of first dorsal. Tail not broad and subcircular at base, longer than disc width or length, with low ridge-like lateral folds. Caudal fin rather long, low; posterior and ventral margins rounded.

COLOUR. Upper surface usually pale brown, preorbital region often paler; sometimes with pinkish hue and darker brownish streak along mid-tail; dorsal and caudal fins translucent. Ventral surface uniformly creamy white.

SIZE. Attains at least 35 cm TL. Matures at ~26 cm TL; born at ~8 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; eastern Australian but probably more widely distributed in the Coral Sea. Benthic on outer continental shelf and upper slope at 140–540 m depths. Biology largely unknown.

SIMILAR SPECIES. Very similar to the West Australian Numbfish (15.26), but has a more brownish rather than yellowish coloration, a slightly smaller disc, and marginally more widely spaced dorsal fins.

ORNATE NUMBFISH

15.28

Narcinops ornata (Carvalho, 2008)

LC

IDENTIFICATION. Small numbfish with a narrow oval to shovel-shaped disc, long snout, nasal curtain wider than long, tail usually longer than disc, low lateral ridge on each side of tail (but lacking distinct fold), and unique pattern of dark brownish blotches and spots on disc, tail and snout. Disc length always longer than wide, broadest near mid-pectoral fin; anterior margin uniformly rounded. Head region rather small; eyes and spiracles very small, eyes slightly bulging. Spiracles smooth, lacking papillae on border, slightly smaller than eyes. Nostrils circular with elevated rims, not divided into 2 separate openings. Nasal curtain long, posterior margin usually with 3 obvious lobes. Upper tooth band slightly wider than lower band, both visible when mouth closed; exposed teeth in up to 18 rows. Pelvic fins long based, not joined together posteriorly. Dorsal fins with rounded apices, slightly smaller than caudal fin; originating over pelvic-fin free rear tips or slightly more forward, separated by space equal to or less than base of first dorsal. Tail broad at base compared to disc, subcircular; longer than both disc width and length, with feeble lateral folds. Caudal fin long, low, posterior margin continuous and rounded.

COLOUR. Upper surface white to pale brownish, covered with distinctive pattern of small to large, dark brown spots and blotches; spots variable in shape and size, up to 6 times eye length and varying from circular to oval; cluster of smaller spots around eye and spiracle. Ventral surface uniformly creamy white.

SIZE. Attains at least 24 cm TL, matures at ~18 cm TL.

HABITAT AND BIOLOGY. Western Central Pacific; northern Australian endemic. Benthic offshore on mid-continental shelf at 48–130 m depths. Biology unknown, few specimens exist in collections.

SIMILAR SPECIES. Of the Australian numbfishes, most similar to the Banded Numbfish (15.30), but differs in disc proportions, relative eye size, and having spotted (rather than banded) markings on dorsal surface.

TASMANIAN NUMBFISH

15.29

Narcinops tasmaniensis (Richardson, 1841)

LC

IDENTIFICATION. Large, plain brownish numbfish with a shovel-shaped disc, short snout, nasal curtain wider than long, tail much longer than disc, and usually with flap-like lateral folds. Disc typically longer than wide, widest toward insertion of pectoral fin; margin broadly rounded anteriorly then concave before apex. Head region small, eyes and spiracles slightly separated. Eyes medium sized. Spiracles smooth, lacking papillae on border, subequal in size to eyes. Nostrils circular with elevated rims, not divided into 2 separate openings. Nasal curtain posterior margin with 3 lobes. Upper tooth band wider than lower band, both visible when mouth closed; exposed teeth in up to 20 rows. Pelvic fins long based and narrow, not joined together posteriorly. Dorsal fins with rounded apices, smaller than caudal fin; originating over pelvic-fin free rear tips, separated by more than base of first dorsal. Tail not broad and subcircular at base; tail longer than disc width or length, with low lateral folds. Caudal fin rather long, low, posterior and ventral margins truncate to broadly rounded.

COLOUR. Upper surface uniformly medium to dark brown, dorsal and caudal fins paler brown; juveniles with darker median stripe and often with dark blotches. Ventral surface white, occasionally with a few irregular dark blotches.

SIZE. Attains at least 47 cm TL. Males and females mature at ~20–21 cm TL; born at 9–12 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean and South-West Pacific; endemic to temperate Australia. Benthic on continental shelf and upper slope to 640 m depths; off New South Wales, most abundant at 100–300 m depths; typically shallower than 100 m off Tasmania. Biology largely unknown; produces 1–8 (usually 3) pups during each gestation.

SIMILAR SPECIES. Generally similar in appearance to the more tropical relatives, the East Australian (15.27) and West Australian Numbfishes (15.26), but has a darker dorsal coloration, shorter snout, and wider lateral tail folds.

BANDED NUMBFISH

15.30

Narcinops westraliensis (McKay, 1966)

LC

IDENTIFICATION. Small numbfish with a subcircular to broadly oval disc, short snout without markings, nasal curtain wider than long, tail longer than disc with low skin folds, and strong pattern of dark brownish cross-bands on upper surface. Disc length usually subequal to width, broadest near mid-pectoral fin; margin uniformly rounded. Head region rather small, eyes and spiracles barely separated. Eyes rather large. Spiracles smooth, lacking papillae on border, slightly smaller than eyes. Nostrils circular with slightly elevated rims, not divided into 2 separate openings. Nasal curtain long, posterior margin usually with 3 lobes. Upper tooth band slightly wider than lower band, upper band often concealed by nasal curtain; exposed teeth in up to 20 rows. Pelvic fins long based, not joined together posteriorly. Dorsal fins usually with broadly rounded apices, more angular in adult males; usually originating over pelvic-fin inner margins, typically separated by less than first-dorsal base. Tail broad based, subcircular, longer than disc length or width, with low lateral folds. Caudal fin rather long, low, posterior margin continuous and rounded.

COLOUR. Dorsal surface pale brown to yellowish with a distinctive pattern of alternating darker brown cross-bands that extend across body and onto dorsal and caudal fins; some bands around edge of disc arranged longitudinally; no bands on snout. Ventral surface uniform white.

SIZE. Attains at least 29 cm TL. Matures at ~18 cm TL; born at ~7 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; endemic to Western Australia. Benthic, on inner continental shelf at 10–70 m depths. Biology unknown, caught occasionally as trawl bycatch.

SIMILAR SPECIES. Resembles an Australian relative, the Ornate Numbfish (15.28), but differs in having a much shorter snout and much larger eye, and a distinctly banded (rather than spotted) pattern of markings on dorsal surface.

16

SLEEPER RAYS

Family Narkidae

M.R. de Carvalho

Sleeper Rays resemble Numbfishes (Narcinidae). They are very small to medium-sized rays, including the smallest living ray maturing at 8–10 cm TL (*Temera hardwickii*), with the largest species (*Electrolux*) reaching more than 50 cm TL. The oronasal region is very distinct (usually with strong upper and lower mental grooves and studded with pores). The number of dorsal fins varies across the 5 genera: single (*Narke*, *Typhlonarke*), paired (*Heteronarce*, *Electrolux*), or lacking (*Temera*). The disc is suboval to circular (*Typhlonarke*), usually with thick margins. Large, kidney-shaped electric organs, situated in the pectoral disc and visible externally, have proportionally fewer and larger columns compared to other electric rays. The head and trunk are depressed but the head is not raised above the disc. Snout is rounded. Mouth narrow with strong labial folds and nasoral groove but weak peripheral groove; circumnarial flaps are well developed. Eyes are small and close together (but vestigial and not visible externally in *Typhlonarke*). Spiracles are usually larger than the eyes, rounded, with elevated rims and lacking papillae in all genera except *Electrolux*. Pelvic fins are broad, rounded or somewhat angular, and completely subdivided into distinct lobes in *Typhlonarke*. The tail is stout and flat, abruptly narrower than the trunk, and may have lateral ridges or folds. Caudal fin is broadly rounded to oval, larger than the dorsal fins, and nearly symmetrical. Skin very soft, without denticles or dermal structures. Dorsal surface brownish, greyish or reddish brown, usually plain or with a simple pattern consisting of large dark spots or blotches, smaller white spots, and/or white bands on tail sides and pelvic-fin bases; only in *Electrolux* is the coloration elaborate. The ventral surface is white, greyish or brownish. Nine species are recognised and they occur in the tropical and temperate Indo–West Pacific, from South Africa to Japan and New Zealand (absent from Australia). Sleeper rays are poorly known, slow-swimming, bottom-dwellers living in depths from inshore to deep water, usually over soft bottoms, down to some 800 m on outer continental and insular slopes. All species are viviparous without a placenta. Prey items are suction fed from soft bottoms and include small benthic invertebrates (such as polychaete worms). Though not utilised as food, sleeper rays are caught as minor bycatch of trawl fisheries at least in Taiwan and Japan. They can deliver a moderate to strong defensive shock when handled.

KEY TO NARKID GENERA

1. No dorsal fin on tail; Indo–West Pacific .... ***Temera* (1 species; fig. 1, p. 180)**

   One or 2 dorsal fins present (figs 2, 6) 2

2. A single dorsal fin present (fig. 2) 3

   Two dorsal fins present (fig. 6) 4

3. Pelvic fins with single lobe, not completely subdivided into anterior and posterior lobes (fig. 4); eyes developed, easily visible externally (fig. 2); Indo–West Pacific .... ***Narke* (3 species; fig. 2, pp. 177–179)**

   Pelvic fins completely divided into 2 separate lobes, 1 anterior and 1 posterior (fig. 5); eyes covered by integument, barely visible externally (fig. 3); South-West Pacific .... ***Typhlonarke* (1 species; fig. 3, p. 181)**

fig. 1

dorsal fin

fig. 2

fig. 3

single-lobed pelvic fin

fig. 4

ventral surface

two lobes

fig. 5

4. Spiracle margins with stiff, slender papillae (fig. 7); nostrils circular; teeth rows in upper jaw more than 25 (~32) rows; dorsal coloration highly elaborate, with many small yellow or white spots (fig. 6); Western Indian Ocean .... ***Electrolux* (1 species; fig. 6, p. 173)**

   Spiracle margins smooth, without papillae (fig. 8); nostrils slit-like; teeth rows in upper jaw less than 25 (~20); dorsal coloration plain, mostly uniform grey, olive or brown, sometimes with some indistinct dark blotches (fig. 9); Indian Ocean .... ***Heteronarce* (3 species; fig. 9, pp. 174–176)**

fig. 6

fig. 7

view of left eye and spiracle

fig. 8

fig. 9

ORNATE SLEEPER RAY

16.1

Electrolux addisoni Compagno & Heemstra, 2007

CR

IDENTIFICATION. Large sleeper ray with a very broad, circular disc, snout very short, papillose spiracles, 2 dorsal fins, and dorsal coloration ornate. Disc anterior margin slightly rounded, almost straight. Head small, eyes and spiracles tightly adjacent. Eyes close to front of disc and covered with loose skin; minute papilla present near eye. Spiracles slightly longer than eyes; spiracular rim low, with 5–6 long, slender and stiff papillae, and 2–3 short and soft papillae. Nostrils rounded, with broad circumnarial flaps. Posterior margin of nasal curtain deeply incised, with prominent lateral lobes and small medial lobe. Nasal curtain with many small pores. Mouth and nostrils project ventrally from disc. Teeth with small, broad-based, triangular cusps; 15–16 rows in upper jaw, arranged in mostly concealed bands. Lower labial folds and grooves short. Pelvic fins broad, with almost straight posterior margins. Claspers short and flat in adult males, not extending beyond pelvic fins. Dorsal fins of similar size or second dorsal slightly smaller than first; rounded to oval at apex. First dorsal-fin origin over pelvic-fin free rear tips, posterior to pelvic-fin insertions. Tail broad and flat; lateral folds broad. Caudal fin broadly rounded to almost straight posteriorly.

COLOUR. Dorsal surface ornate, dark brownish or greenish brown, covered with numerous small paler spots (usually much smaller than eyes) and streaks; also with concentric black lines and pale spots. Undersurface creamy white with broad, dark brown to greenish brown margins covered with pale spots (similar to dorsal surface).

SIZE. Largest member of family, adult males attain 50–52 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; South Africa from Coffee Bay (Eastern Cape Province) to Durban (KwaZulu-Natal). Benthic on inner continental shelf on soft and rocky bottoms at 2–50 m depths. Diurnal feeder of crustaceans and polychaetes.

SIMILAR SPECIES. *Heteronarce* also have 2 dorsal fins, but no other family member has such a striking colour pattern and papillose spiracles.

EILAT SLEEPER RAY

16.2

Heteronarce bentuviai (Baranes & Randall, 1989)

DD

IDENTIFICATION. Very small sleeper ray with a subcircular disc, short snout, 2 dorsal fins, and more striking colour pattern than other members of the genus (reddish brown with dark spots on electric organs, and dorsal and caudal fins). Disc almost equal in length and width, these about half total length; anterior margin broadly rounded. Head rather small. Eyes small, oval, contiguous with spiracles. Spiracle larger than eye, circular, with low spiracular rim, without papillae. Nostrils elongate, slit-like. Nasal curtain with pores; posterior margin more or less straight. Lower labial folds and grooves short. Teeth in 9–11 rows in each jaw, not visible externally. Pelvic fins broad, with slightly rounded posterior margins. Claspers of adult male short, barely extending beyond pelvic-fin rear tips. Dorsal fins similar in shape, but second more slanted; first dorsal much larger than second, with pointed, triangular apex and origin over mid-length of pelvic fins. Tail stocky and short; lateral folds slender, inconspicuous. Caudal fin tall, much larger than dorsal fins, with slanted upper margin, low ventral margin, and broadly rounded posterior margin.

COLOUR. Dorsal surface reddish brown, brownish or yellowish; covered with large, clearly delimited, dark blackish brown or black spots near pectoral-fin insertions; spots on first dorsal fin and caudal-fin upper lobe; pair of poorly defined blotches dorsally over electric organs. Undersurface creamy white.

SIZE. Reaches ~20 cm TL; a male was mature at ~15 cm TL.

HABITAT AND BIOLOGY. Indian Ocean; Red Sea (Gulf of Aqaba) and Gulf of Aden. Benthic on outer continental shelf at 80–200 m depths. Material rare; specimens from Gulf of Aden and Red Sea differ slightly. Probably feeds on invertebrates on soft bottoms, such as polychaetes and crustaceans.

SIMILAR SPECIES. In addition to a more striking colour pattern, differs from the Natal (16.3) and Soft Sleeper Rays (16.4) in having more numerous pores on the nasal curtain, more triangular first dorsal fin much larger than the second, and shorter claspers.

NATAL SLEEPER RAY

16.3

Heteronarce garmani Regan, 1921

VU

IDENTIFICATION. Small sleeper ray with a circular to shovel-shaped disc, snout long, 2 dorsal fins, small eyes and spiracles of similar size, small oronasal region, and almost uniform dorsal coloration. Disc longer than wide in preserved specimens, slightly more circular when fresh; widest posterior to its mid-length; anterior margin broadly oval to subcircular. Head rather small. Eyes small, oval, contiguous with spiracles. Spiracles circular, slightly smaller or subequal to eye diameter; spiracular rim low, ridge-like, and without papillae. Nostrils elongate, slit-like, nearly as long as nasal curtain, more circular in fresh specimens. Nasal curtain small, usually without pores, with weak median groove; posterior margin broadly rounded or straight, and slightly fringed. Lower labial folds slender, with weak symphysial and lower labial grooves. About 12 tooth rows in each jaw; teeth minute, barely visible externally. Pelvic fins and tail slightly more slender than other species of genus. Claspers of adult male extending just beyond pelvic-fin rear tips. First dorsal-fin origin over pelvic-fin rear tips. Second dorsal fin slightly larger and more rounded at apex than first dorsal; lateral folds rather broad. Caudal fin about as long as tall, larger than dorsal fins, with almost straight posterior margin.

COLOUR. Dorsal colour light to dark brown, usually uniform but with small indistinct darker markings sometimes present; ventrally creamy white, sometimes with faint brown posterior disc margin.

SIZE. Possibly to 25–30 cm TL, males mature at ~17 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; Algoa Bay to Natal (South Africa), and off Mozambique. Continental shelf and upper slope at depths of 70–330 m. Life history unknown.

SIMILAR SPECIES. Commonly caught *Heteronarce* but still rare in collections. Snout relatively longer than other members of the genus but may prove to be identical to the Soft Sleeper Ray (16.4). Specimens identified from Madagascar are a species of *Narcine*.

SOFT SLEEPER RAY

16.4

Heteronarce mollis (Lloyd, 1907)

DD

IDENTIFICATION. Small sleeper ray with a very broad, circular disc, short snout, 2 dorsal fins, spiracles larger than eyes, enlarged oronasal region, and almost uniform dorsal coloration. Disc anterior margin broadly rounded to suboval. Head proportionally small, with eyes and spiracles tightly adjacent. Eyes slightly bulging. Spiracle larger than eye diameter, circular with low, ridge-like spiracular rim. Nostrils subcircular (slit-like in preserved specimens), with broad circumnarial flaps. Nasal curtain wide and long, with few small pores more abundant on ventral snout, and with weak median groove. Nasal curtain slightly wider posteriorly, posterior margin slightly incised at mid-width; fringes sometimes present. Lower labial groove deep; symphysial groove present. Teeth small, triangular and broad based, mostly hidden from view, in 10–16 rows in each jaw. Pelvic fins broad. Claspers cylindrical, extending beyond pelvic-fin posterior margins in adult male. Dorsal fins of similar size, upper margin of second dorsal slightly more slanted; first dorsal broadly rounded at apex; second dorsal more oval. Origin of first dorsal fin over pelvic-fin rear tips. Tail broad and slightly flat; lateral tail folds slender but not ridge-like. Caudal fin larger than dorsal fins, with more slanted upper margin, oval apex, and broadly rounded posterior margin.

COLOUR. Dark brown, reddish brown to greyish brown dorsally, covered with small, irregular, pale and/or dark markings (often faint) over disc. Undersurface white, tan or greyish.

SIZE. Probably exceeds 30 cm TL; a male ~20 cm TL was mature.

HABITAT AND BIOLOGY. Indian Ocean; Somalia to Arabian Sea (off India). Known from few specimens. Benthic on soft bottoms of continental shelf and upper slope at depths of 80–345 m. Biology and reproduction unknown.

SIMILAR SPECIES. Resembles the Natal Sleeper Ray (16.3), but differs slightly in dorsal colour and proportions of the head. *Heteronarce prabhui* Talwar, described from Quilon (India), is a synonym.

CAPE SLEEPER RAY

16.5

Narke capensis (Gmelin, 1789)

DD

IDENTIFICATION. Small to medium-sized sleeper ray with a subcircular disc, 1 dorsal fin, and almost uniform yellowish or greenish brown dorsal coloration. Disc longer than wide in preserved specimens, more circular in fresh material; anterior margin broadly rounded to oval. Head small, not distinctly raised above disc. Eyes small, close to front edge of disc and positioned close to spiracles. Spiracle larger than eye diameter, circular; spiracular rim low and ridge-like, without papillae. Incurrent apertures of nostrils small, rounded. Nasal curtain short, with few pores, and strong median and lower labial grooves; lower labial folds short, numerous. Teeth small, subtriangular, ~14–16 rows in each jaw. Pelvic fins broad and elongate, more or less straight on outer margins. Claspers of adult male extend slightly beyond pelvic-fin rear tips. One low, rounded dorsal fin, originating over pelvic-fin rear tips. Tail broad and slightly flat; lateral tail folds slender and short. Caudal fin elongate, broadly rounded dorsally, low ventrally, and close to and larger than dorsal fin.

COLOUR. Dorsal surface yellowish to greenish brown, with slightly darker outer disc margin; sometimes with a few poorly defined, darker brown blotches or streaks of varying sizes on central disc, or small dark spots. Ventral surface yellowish or creamy white with brownish outer disc margin.

SIZE. Possibly reaches 38 cm TL. Males mature at 18–23 cm TL, females at ~23 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; Cape of Good Hope to Natal (South Africa); reports from Namibia, Madagascar and Mozambique need confirmation. Benthic on soft and rocky bottoms of the continental shelf at 20–115 m depths, but possibly to 180 m. Feeds primarily on benthic invertebrates. Produces a powerful shock to humans.

SIMILAR SPECIES. Possibly co-occurs in the Indian Ocean with the Natal (16.3) and Ornate Sleeper Rays (16.1), but has 1 dorsal fin (2 fins in other species). Coloration and body proportions distinguish this species from other *Narke*.

SPOT-TAIL SLEEPER RAY

16.6

Narke dipterygia (Bloch & Schneider, 1801)

DD

IDENTIFICATION. Small sleeper ray with a subcircular disc, short snout, 1 dorsal fin, and large whitish blotches on usually brown to reddish brown dorsal surface. Disc longer than wide in preserved specimens, more circular when fresh; anterior margin broadly rounded to somewhat straight. Head small, with eyes and spiracles tightly adjacent. Eyes small, sometimes concealed by spiracular rim. Spiracles much larger than eyes, spiracular rim usually low (larger in fresh material). Nostrils circular. Nasal curtain short and wide in fresh material (more slender in preserved specimens), wider posteriorly; usually with many pores and strong median groove; posterior margin more or less straight. Teeth small, with broad bases and small triangular cusps in adult males; 16–18 rows in each jaw, not visible externally. Pelvic fins broad in fresh material, angular when preserved. Claspers short and flat in adult males, extending just beyond pelvic-fin rear tips. Single dorsal fin rounded to oval at apex, smaller than caudal fin, originating over pelvic-fin free rear tips. Tail broad and flat; lateral tail fold slender to moderately broad. Caudal fin broadly rounded to oval or slightly trapezoidal, with low ventral lobe and straight to broad posterior margin.

COLOUR. Medium to dark brown or reddish brown above; usually well-defined creamy blotches above pelvic fins bases, pectoral-fin insertions, and along base of tail. Ventral surface white, sometimes posterior disc margins brownish.

SIZE. Reaches at least 25 cm TL; commonly to 20 cm TL and reported to 35 cm TL; adult males and females known at 15 cm TL.

HABITAT AND BIOLOGY. Indo–West Pacific; Oman (Arabian Sea) to north-east Asia (China and Japan). Benthic from nearshore to over 100 m depth. Feeds on crustaceans and polychaetes. Produces 4–6 young each gestation.

SIMILAR SPECIES. Distinguished from other *Narke* species by its dorsal colour pattern. However, coloration varies and the species may be a complex; Arabian Sea populations are larger and more reddish.

JAPANESE SLEEPER RAY

16.7

Narke japonica (Temminck & Schlegel, 1850)

VU

IDENTIFICATION. Small sleeper ray with a subcircular disc, short snout, 1 dorsal fin, and almost uniform dorsal coloration but lateral tail usually lighter. Disc usually longer than wide in preserved specimens; anterior disc margin slightly rounded to straight. Head not projecting dorsally above disc, rather small. Eyes and spiracles closely adjacent. Spiracles larger than eye diameter, circular; spiracular rim low to moderately developed, without papillae. Incurrent apertures of nostrils circular with slender circumnarial flaps. Nasal curtain short, with pores and strong median groove; posterior margin more or less straight, lower labial folds and grooves short. Tooth row count low, ~12–14 in each jaw. Pelvic fins broad, wider than long, and not very elongate. Claspers of adult male extending beyond pelvic-fin free rear tips. Dorsal fin broadly rounded at apex, low; origin well posterior to pelvic-fin free rear tips. Tail broad, flat; lateral tail folds rather broad posteriorly. Caudal fin much larger than dorsal fin, lobe-like, subtrapezoidal to oval in shape, with broadly rounded posterior margin.

COLOUR. Dorsal surface pale brownish to orange-brown, sometimes with isolated darker blotches, usually very few in number, present on disc; lateral tail region lighter in many specimens, with lighter streaks on dorsolateral tail. Ventrally creamy white.

SIZE. Reaches ~30 cm TL, mature males known at 25 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; China to Japan, including Taiwan. Benthic on soft or gravelly bottoms, nearshore to over 100 m depth. Biology mostly unknown, but locally common in Taiwan and Japan. Produces 4–6 pups per litter. Not used for food. Produces a moderate shock to humans.

SIMILAR SPECIES. Distinguished from other *Narke* by its dorsal colour and body proportions. *Crassinarke dormitor* Takagi is a synonym that is based on specimens with a narrower disc and pelvic fins, smaller dorsal and caudal fins, more elongate tail, and other features often associated with poor preservation.

FINLESS SLEEPER RAY

16.8

Temera hardwickii Gray, 1831

VU

IDENTIFICATION. Very small sleeper ray with a disproportionately large circular disc, no dorsal fins, very short caudal peduncle, and almost uniform dorsal coloration. Disc anterior margin broadly rounded. Head small; eyes and spiracles tightly adjacent. Eyes very small and oval, slightly bulging and close to front of disc. Spiracles circular, slightly larger than eyes; interspiracular distance narrower than interorbital distance; rim low, distinct and without papillae. Nostrils rounded; circular and slender circumnarial flaps. Nasal curtain short, wider posteriorly, sometimes with small median posterior lobe; pores lacking or sparse, densest on anterior ventral snout and posterior to mouth. Median and lower labial grooves inconspicuous or absent. Pelvic fins rather large and broad, with broadly triangular apices and almost straight posterior margins. Claspers slender, short and flat in adult males, extending well beyond pelvic-fin free rear tips. Tail very short, flat, broad based and strongly tapered; lateral tail folds low, barely noticeable. Caudal fin usually with slanted upper margin, broadly triangular to rounded apex, upright to slightly rounded posterior margin, and low ventral margin.

COLOUR. Dark brown dorsally on disc, pelvic fins and tail, sometimes with darker streaks not forming specific patterns. Ventral surface creamy white or tan; tail, and outer margins of disc and pelvic fins, pale brown or grey.

SIZE. Attains at least 15 cm TL; reports to 48 cm TL probably erroneous. Males mature at 8–10 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean and North-West Pacific; Thailand to Vietnam, including Malaysia. Benthic, primarily inshore on soft substrates. Presumably feeds on small benthic invertebrates. Four pups reported in 1 pregnant female.

SIMILAR SPECIES. Considered to be smallest known living batoid and no other electric ray lacks dorsal fins. Otherwise resembles the Spot-tail Sleeper Ray (16.6), but has a larger and more circular disc and is very different around the mouth and nostrils.

BLIND SLEEPER RAY

16.9

Typhlonarke aysoni (Hamilton, 1902)

DD

IDENTIFICATION. Distinctive large sleeper ray with a greatly enlarged subcircular to oval disc, short snout, concealed eyes, bilobed pelvic fins, very short tail with 1 small dorsal fin, and a uniform dark greenish or brownish dorsal coloration. Disc anterior margin broadly rounded; anteroventral disc with many sensory pores. Electric organs with comparatively few columns of large cells. Head small; eyes not visible externally, completely concealed by skin. Spiracles circular, with low spiracular rim devoid of papillae. Nasal curtain tapering anteriorly, with many small pores posteriorly. Mouth and nostrils can project ventrally in a tube-like manner. Nostrils small, circular, with slender circumnarial flaps. Lower labial folds well developed, with marked symphysial groove. Teeth broad and small, with triangular apices, in 10–12 rows in both jaws, concealed by thick lips. Pelvic fins divided into 2 completely separate lobes; anterior lobe appendage-like, just anterior to cloaca; posterior lobe broad, more or less confluent with posterior disc, only separated by a web of skin. Claspers short and flat in adult males, not usually extending beyond disc. Dorsal fin apex rounded to oval, slanted posteriorly, close to caudal fin; its origin anterior to origin of pelvic-fin posterior lobe. Tail broad and flat; lateral tail folds absent. Caudal fin elongate, narrow, apex broadly rounded, and fin much larger than dorsal fin.

COLOUR. Uniform dark brownish or greenish above, sometimes paler along disc margins and darker posteriorly on body. Underside uniform brownish; mouth and mid-pelvic regions pale.

SIZE. Attains 45 cm TL, reports to 90 cm certainly erroneous. Mature males at 35–40 cm TL; born at 9–10 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; New Zealand endemic. Uncommon, benthic on soft substrates at 50–800 m depths, most common at 300–400 m. Produces litters of up to 11 pups.

SIMILAR SPECIES. No other sleeper ray has subdivided pelvic fins. *Typhlonarke tarakea* Phillipps is probably based on a poorly preserved specimen of *T. aysoni*.

17

COFFIN RAYS

Family Hypnidae

P.R. Last, W.T. White & M.R. de Carvalho

A monotypic family, the Coffin Rays have a pear-shaped soft body and very short tail, and grows to about 60 cm TL. Unlike other electric rays, the disc is unusually broad and thickened, and its greatly enlarged, single-lobed pelvic fins form a smaller posterior pelvic disc. The snout is straight to truncate. Minute eyes are narrowly separated and centred well away from the disc margin. Spiracles are small and bordered with small papillae. Small, circular nostrils are connected to the mouth by a deep groove, and separated by a narrow nasal curtain. The mouth is broadly arched, widely distensible, with unique tricuspid teeth. Skin smooth, lacking denticles of any kind. Large kidney-shaped electric organs are located in the pectoral disc but electric organs are absent from the tail. The tail is very short, just less than the pelvic-fin width, and lacks a caudal sting. Two small dorsal fins and a single-lobed caudal fin of similar size are situated close together near the tail tip. The Coffin Ray is usually plain coloured on both surfaces (sometimes with a few irregular darker or paler spots and blotches), being lighter ventrally. The family consists of a single benthic marine species that lives on the continental shelf of tropical and warm temperate Australia. The Coffin Ray buries itself in a variety of soft substrates and sometimes ventures into estuaries, but not freshwater. Viviparous (aplacental) with litters of 4–8 pups. Prey consists mainly of bony fishes, as well as cephalopods and crustaceans, which are stunned by the powerful electric organs located in the pectoral disc. Occasionally taken as bycatch of net fisheries but usually discarded.

COFFIN RAY

17.1

Hypnos monopterygius (Shaw, 1795)

LC

IDENTIFICATION. Medium-sized electric ray with large, strongly depressed pectoral and pelvic discs, a very short tail with small dorsal and caudal fins of similar size (situated close together), and a plain dorsal coloration, sometimes with darker blemishes. Pectoral disc slightly longer than wide and thick, pelvic disc more circular and much smaller; pelvic fins broadly rounded, joining tail beneath origin of caudal fin. Snout moderately elongate, anterior margin noticeably truncate, usually weakly concave at its tip. Eyes and spiracles narrowly separated. Nostrils small and circular, with tube-like circumnarial flaps. Mouth broadly arched, much wider than distance between nostrils, and without labial furrows and enlarged grooves. Flesh flabby and skin smooth but often creased after capture, without denticles. Dorsal fins rather small, their size and shape similar, with broadly rounded apices; their height about equal to or exceeding distance between spiracles; fin margins almost touching each other. Caudal fin small, broad, lobe-like, its margin almost continuous with second dorsal fin and of similar size.

COLOUR. Greyish, dark brown to reddish brown dorsally, sometimes with scattered light or dark irregular blotches and spots; papillae around spiracles white. Ventral side uniformly white or yellowish.

SIZE. To at least 63 cm TL, sexes mature at 40–48 cm TL; born at ~8–11 cm TL.

HABITAT AND BIOLOGY. South-West Pacific and Eastern Indian Ocean; Australian endemic. Benthic, occurs on soft substrates off beaches and in bays, mainly inshore to ~80 m in depth (although reported from upper continental slope to 220 m). Capable of delivering a powerful electric shock to stun prey. Fishes of similar size to themselves have been found in the stomachs of Coffin Rays, ingested whole through their large gape.

SIMILAR SPECIES. A combination of a greatly enlarged disc, very short tail and posteriorly placed dorsal fins distinguishes this unusual species from the closely related torpedo rays and their allies.

18

TORPEDO RAYS

Family Torpedinidae

M.R. de Carvalho, P.R. Last & B. Séret

Torpedo rays are small to large batoids (to 1.8 m TL but mostly smaller than 1 m TL; 1 species matures at ~20 cm TL). The disc is rather depressed and variably subcircular, about as wide as long, with thick, fleshy margins. Snout is straight to slightly arched along its margin. Small or medium-sized eyes and spiracles are usually situated close together well forward on disc. There are 2 genera in the family, *Tetronarce* and *Torpedo*. Spiracles either smooth edged (*Tetronarce*) or with slender or knob-like papillae on posterior and lateral margins (*Torpedo*). Nostrils subcircular and relatively large, connected to mouth by deep nasoral grooves. Nasal curtain narrow to broad with a smooth posterior margin, sometimes with a small median lobe. Mouth strongly arched, with a wide gape. Teeth with a single cusp and numerous (in 25–70 rows in adults). Large, kidney-shaped electric organs are usually visible on both sides of the disc, but more visible in ventral view. Pelvic fins broad and rounded, each with a single lobe. Two rounded to angular dorsal fins, the first usually larger than second. The caudal fin is large and subtriangular, with upper and lower lobes of more or less equal size. Tail is stout and clearly demarcated from, but shorter than, the disc. A low lateral skin fold is present on either side of the tail. Skin very soft and smooth, without denticles. Dorsal surface is uniform brown, dark grey, purplish or blackish (*Tetronarce*), or with various light and dark markings (ocellated, spotted, mottled or vermiculated) on variable shades of brown or grey (*Torpedo*). The ventral surface is typically whitish, often with dark pectoral and pelvic-fin margins. Torpedo rays are found worldwide in temperate and tropical shallow coastal regions (*Torpedo*), and mainly in the pelagic realm or in deeper waters of the continental slope (*Tetronarce*). They are typically slow swimmers living on the bottom, although some spend time migrating in midwater. Their electric organs produce strong discharges used to stun prey as well as for defence. Prey items (mostly bony fishes but also benthic invertebrates) are grasped and ingested whole. All species are viviparous without placentae. Sometimes caught as bycatch and usually discarded at sea. The family is undergoing taxonomic revision, and while 18 species are treated here, at least another 7 undescribed *Torpedo* species have been discovered. Also, some species of *Tetronarce* in this book may be synonyms. Some species are very similar in appearance and individuals can be extremely variable within species, so identifying and defining species has proven difficult. Research is needed to define species and determine their true distributional ranges.

KEY TO TORPEDINID GENERA

Spiracle margins smooth and without any knobs or papillae (fig. 1); cosmopolitan ....
.... ***Tetronarce*** **(8 species; fig. 3, pp. 186–193)**

Spiracle margins with few to many knobs or papillae (fig. 2); Atlantic and Indian Oceans ....
.... ***Torpedo*** **(10 species; fig. 4, pp. 194–203)**

view of left eye and spiracle

edge of spiracle

fig. 1

knobs and papillae

fig. 2

fig. 3

fig. 4

PACIFIC TORPEDO

18.1

Tetronarce californica (Ayres, 1855)

LC

IDENTIFICATION. Very large torpedo ray usually with a dark-spotted bluish or greyish dorsal colour, and smooth spiracles devoid of papillae. Disc broadly circular, slightly wider than long, widest near its mid-length; anteriormost margin usually weakly convex and without median protuberance. Eyes small, slightly smaller than spiracles. Spiracles large, crescent shaped, rims not elevated. Mouth strongly arched; nostrils large, round and with well-developed nasal flaps. Teeth small and sharp. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins very broad, margins evenly rounded. Dorsal fins with broadly rounded to oval apices; second dorsal fin more slanted and much smaller than first; height of each ~1.5 times their length. First dorsal-fin insertion usually over pelvic-fin insertions or slightly forward; dorsal fins separated by about length of first dorsal base; distance between second dorsal and caudal fin equal to or greater than interdorsal distance. Tail short, shorter than disc length, tapering. Caudal peduncle rather slender with low skin folds. Caudal fin large, with both upper and lower lobes tall and broad; posterior margin straight to weakly concave.

COLOUR. Bluish, greyish or dark greyish brown above, usually with an irregular scattering of small black spots on body and fins. Undersurface creamy or white.

SIZE. To ~137 cm TL; males mature at ~65 cm TL, females at ~73 cm TL.

HABITAT AND BIOLOGY. North Pacific Ocean; off western USA and Japan. Demersal over continental and insular shelves, often in shallow coastal habitats, at depths of 5–275 m. Produces litters of up to 17 pups. Feeds exclusively on fishes that are usually ambushed from beneath sediment during the day or actively stalked in open water at night.

SIMILAR SPECIES. Very similar in appearance to other members of this genus, but distinctive in its dark-spotted dorsal colour. Black-spotted *Tetronarce* caught in the northern Indian Ocean are of uncertain identity.

SOUTH AFRICAN TORPEDO

18.2

Tetronarce cowleyi Ebert, Haas & Carvalho, 2015

NE

IDENTIFICATION. Large torpedo ray with a greyish or black dorsal colour, without distinctive spots or dorsal markings, and smooth spiracles lacking papillae. Disc broadly rounded, clearly wider than long, width 65–70% TL, widest at its anterior third, thick at anterior margin; anterior margin with a small median protuberance. Eyes and spiracles small. Spiracles oval to round, slightly oblique in relation to eyes, flat. Nostrils large, round and with distinct flaps, their posterior margins with 2 confluent lobes, broad and angled medially; nasal curtain margins not fringed. Mouth strongly arched; teeth small and sharp, in 32 rows in largest males. Electric organs more clearly visible in ventral than dorsal view. Pelvic-fin outer margin broadly rounded, but fin not particularly broad. Claspers with small, distal integumental flap. Dorsal fins rounded to oval at apex; second dorsal fin more slanted and much smaller than first. First dorsal-fin origin slightly forward of pelvic-fin insertion; origin of second near tail mid-length; interdorsal distance subequal to distance between second dorsal and caudal fin. Tail stout and short, length slightly shorter than disc length, with ridge-like skin folds. Caudal fin large, with upper lobe slightly more angled than lower lobe, with oval apex; lower lobe more rounded; posterior margin of caudal fin straight to rounded.

COLOUR. Uniform shiny black or dark greyish above; ventral surface creamy white.

SIZE. Females reach 113 cm TL and males 68 cm TL; females mature at ~100 cm TL, males ~58 cm TL; born before 19 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; Namibia to Algoa Bay (South Africa). Demersal on the outer continental shelf and upper slope at depths of 110–455 m. Feeds mainly on fishes.

SIMILAR SPECIES. This species is most similar to the Argentine Torpedo (18.6), and their separation is mostly based on subtle differences in body proportions.

TAIWANESE TORPEDO

18.3

Tetronarce formosa (Haas & Ebert, 2006)

DD

IDENTIFICATION. Medium-sized torpedo ray with a uniform purplish brown dorsal colour, first dorsal fin not extending beyond rear tip of pelvic fin, truncate or weakly concave caudal fin, and smooth spiracles lacking papillae. Disc broadly circular, considerably wider than long, widest near mid-length; anteriormost margin weakly convex to somewhat truncate; without median protuberance. Eyes smaller than spiracle. Spiracles moderately elongate, narrowly oval to slit-like, rims not elevated. Nostrils small, round, with distinct flaps. Mouth small, strongly arched; teeth small and sharp, in up to 23/27 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins not very broad, margins rounded to angular. First dorsal fin broad, subtriangular; second dorsal fin distinctly more slanted, much smaller than first, and with a more acute apex. First dorsal-fin insertion about over pelvic-fin insertions; dorsal fins separated by shorter than base length of first; distance between second dorsal and caudal fin usually larger than interdorsal distance. Tail moderately short, stout, tapering, smaller than disc length; caudal peduncle rather slender, with low ridge-like skin folds. Caudal fin large, lobes tall and broad, height usually exceeding its distance from first dorsal-fin origin; posterior margin straight to undulate, slightly more concave with more angular tips in large males.

COLOUR. Uniform purplish brown above, with darker hue around margins of disc and pelvic fins and on caudal fin; lateral skin fold creamy. Undersurface creamy or white, usually narrowly and abruptly darker on posterior disc and pelvic-fin margins, claspers, and edges of tail.

SIZE. To at least 62 cm TL; born at ~20–25 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Taiwan and possibly Philippines. Demersal, primarily offshore to depths of 300 m. Life history unknown.

SIMILAR SPECIES. Occurs with the Longtail Torpedo (18.7) off Taiwan. These forms differ in disc and caudal-fin shapes, and the relative length of tail. However, given the high level of variability within some members of this genus, they may turn out to be variations of the same species.

GREAT TORPEDO

18.4

Tetronarce nobiliana (Bonaparte, 1835)

DD

IDENTIFICATION. Very large torpedo ray, usually with a plain-coloured, dark brown to purplish brown dorsal surface, first dorsal fin usually extending posteriorly well beyond rear tip of pelvic fins, truncate or weakly concave caudal fin, and smooth spiracles lacking papillae. Disc broadly circular, considerably wider than long, width 58–71% TL, widest near its mid-length; anteriormost margin weakly convex to truncate. Eyes smaller than spiracle. Spiracles large, narrowly oval, rims barely elevated. Nostrils small, round, with distinct flaps. Mouth strongly arched; teeth small and sharp, in more than 50 rows in larger specimens. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins much broader than long, margins evenly rounded. Dorsal fins broad to narrowly rounded at apex; height of first ~1.2–1.3 times its base length, second much smaller. First dorsal-fin position variable, usually over pelvic fins; dorsal fins separated by about base length of first dorsal or less; distance between second dorsal and caudal fin usually larger than interdorsal distance. Tail shorter than disc length, tapering; caudal peduncle rather slender with low skin folds. Caudal fin large, both lobes tall and broad; posterior margin almost straight to weakly concave in adults.

COLOUR. Variably brownish or greyish above; often with bluish hues and light or dark flecks. Undersurface of disc white, occasionally with dark margins.

SIZE. To ~180 cm TL (Atlantic); males mature at ~60 cm TL (South Pacific).

HABITAT AND BIOLOGY. Indo–Pacific and Eastern Atlantic Ocean, including Mediterranean Sea; widespread, primarily in temperate latitudes. Demersal on continental and insular shelves and slopes to at least 925 m depth. Makes long pelagic migrations, often near the surface. Produces litters of up to 60 pups. Preys mainly on bony fishes.

SIMILAR SPECIES. Extremely variable in shape and colour; *T. fairchildi* (Hutton) and *T. macneilli* (Whitley) are synonyms. However, the Western Atlantic Torpedo (18.5), previously considered a synonym, is now recognised as a valid species based on molecular data.

WESTERN ATLANTIC TORPEDO

18.5

Tetronarce occidentalis (Storer, 1843)

NE

IDENTIFICATION. Very large torpedo ray usually with a plain brownish dorsal coloration lacking distinctive spots or markings, and smooth spiracles lacking papillae. Disc broadly circular, wider than long, widest slightly beyond its mid-length; anteriormost margin almost straight, lacking a small median protuberance. Eye much smaller than spiracle. Spiracles large, slit-like, with low but slightly elevated rims. Nostrils large, round to oval and with distinct flaps. Mouth strongly arched; teeth small and sharp, in 38–66/38–61 rows, increasing in number during growth. Electric organs more clearly visible in ventral than dorsal view. Pelvic-fin outer margin rounded, but not particularly broad. Dorsal fins narrowly rounded at apex; second dorsal fin more slanted and always much smaller than first. First dorsal-fin insertion about over pelvic-fin insertions; second dorsal usually centred slightly forward of tail mid-length; distance between second dorsal and caudal fin larger than interdorsal distance. Tail short and stout based, tapering rapidly, length ~42% TL; caudal peduncle slender with low and short skin folds. Caudal fin large, with upper lobe similarly angled to lower lobe; posterior margin of fin straight to weakly concave.

COLOUR. Uniform chocolate brown, purplish or blackish brown on dorsal surface. Undersurface generally white, sometimes edges of disc and pelvic fins brownish; tail may have dark markings.

SIZE. Reaches at least 154 cm TL and at least 60 kg; males mature at 75–85 cm TL, females 125–135 cm TL.

HABITAT AND BIOLOGY. North-West Atlantic; mainly eastern USA, rarely south to Venezuela. Demersal, from shoreline to ~530 m depth. Life history largely unknown.

SIMILAR SPECIES. Previously thought to be identical to the Great Torpedo (18.4), but recognised as a distinct species based on new DNA analyses. However, these species have not been adequately distinguished on morphology and more research is needed. Its relationship with a south-western Atlantic species, the Argentine Torpedo (18.6), also needs further investigation.

ARGENTINE TORPEDO

18.6

Tetronarce puelcha (Lahille, 1926)

DD

IDENTIFICATION. Large torpedo ray with a distinctive brownish, greyish or blackish dorsal colour, without distinctive spots or dorsal markings, and smooth spiracles devoid of papillae. Disc broadly circular, slightly wider than long, width 65–73% TL, widest at its anterior third; anteriormost margin almost straight, sometimes with a median protuberance. Eyes slightly smaller than spiracles. Spiracles large and rounded to oval, with low but slightly elevated rims. Nostrils large, round and with distinct flaps. Mouth strongly arched; teeth small and sharp, in ~35–37 rows in adult males, slightly more in larger females. Electric organs more clearly visible in ventral than dorsal view. Pelvic-fin outer margin rounded, but not particularly broad. Dorsal fins rounded to oval at apex; second dorsal fin more slanted and much smaller than first. First dorsal situated almost entirely over posterior pelvic fins; second dorsal at tail mid-length; distance between second dorsal and caudal fin slightly larger than interdorsal distance. Tail rather short, length smaller than disc length; stout with a low lateral skin fold. Caudal fin large, with upper lobe slightly more angled than lower lobe; posterior margin of fin straight to rounded slightly.

COLOUR. Uniform greyish, dark brownish, black or even purplish brown on dorsal surfaces; creamy white ventrally. Variation in dorsal colour is independent of preservation, as fresh specimens may vary from grey to brown or black.

SIZE. Reaches 120 cm TL. Males mature at 62–67 cm TL; largest known specimens are females.

HABITAT AND BIOLOGY. South-West Atlantic; more common off southern Brazil than either Uruguay or Argentina. Feeds primarily on fishes. Little else known of its biology.

SIMILAR SPECIES. Resembles the larger Great Torpedo (18.4) in colour and overall appearance, but largely differs in tooth row counts and aspects of body proportions.

LONGTAIL TORPEDO

18.7

Tetronarce tokionis (Tanaka, 1908)

DD

IDENTIFICATION. Medium-sized to large torpedo ray with a dark dorsal surface, posterior margin of first dorsal fin behind pelvic-fin tip, strongly emarginate caudal fin in adults, and smooth spiracles devoid of papillae. Disc almost circular and thick, width about equal to length; anteriormost margin usually convex, without median protuberance. Orbits largely concealed, eyes small, about half of spiracle length. Spiracles moderately elongate, suboval, rims not elevated. Nostrils small, round, with distinct flaps. Mouth small, arched; teeth small and sharp, in up to 30 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins rather narrow, margins rounded to angular. First dorsal fin rounded to narrow; second dorsal fin considerably smaller than first and with a more narrowly rounded apex. First dorsal-fin posterior margin well behind pelvic-fin insertions; dorsal fins separated by about base-length of first dorsal; distance between second dorsal and caudal fin slightly larger than interdorsal distance. Tail rather elongate and narrow, with slender taper; caudal peduncle slender with low skin folds. Caudal fin rather large, lobes long and angular, height much less than its distance from first dorsal-fin origin; posterior margin distinctly concave.

COLOUR. Dark chocolate brown, blackish along hind margins of disc and pelvic fins; often with dark scar-like markings above; anterior base of pelvic fin and region beside eye and spiracle usually lighter. Undersurface uniformly white.

SIZE. Apparently reaches 114 cm TL but typically much smaller; males mature at ~68 cm TL; born at ~20 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Taiwan to Hokkaido (Japan). Demersal on continental slope at 220–1100 m depths. Caught occasionally as trawl bycatch, but life history unknown.

SIMILAR SPECIES. Some species of *Tetronarce* vary greatly in body shape. The co-occurring Taiwanese Torpedo (18.3) is thought to have a relatively broader disc, less angular caudal fin and shorter tail, but these species need closer scrutiny to confirm they are different species. Long-tailed forms occurring in other parts of the Indo–Pacific are presently considered variants of other species.

CHILEAN TORPEDO

18.8

Tetronarce tremens (de Buen, 1959)

DD

IDENTIFICATION. Medium-sized to large torpedo ray with a plain greyish upper surface, first dorsal fin usually completely over pelvic fin, caudal fin truncate or weakly convex, and smooth spiracles devoid of papillae. Disc broadly circular, wider than long, widest near its mid-length; very large specimens sometimes with laterally angular disc; snout anterior margin usually weakly convex, with median protuberance. Eyes small, clearly smaller than spiracle length. Spiracles large, oval, rims barely elevated. Nostrils small, oval, with distinct nasal flaps. Mouth small, strongly arched; teeth small and sharp. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins rather narrow and short, broadly rounded posteriorly. First dorsal fin broad, rounded at apex, its height up to 1.5 times its base length; second dorsal fin much smaller, more slanted, and with oval apex. First dorsal fin entirely over pelvic fins; dorsal fins usually separated by less than base length of first dorsal; distance between second dorsal and caudal fin much larger than interdorsal space. Tail rather short, broad based, shorter than disc length, tapering; caudal peduncle slender with low lateral skin folds. Caudal fin large, both lobes tall and broad, rounded at apices; posterior caudal margin straight to rounded slightly.

COLOUR. Uniform dark greyish to bluish brown above, often heavily scarred. Undersurface white, usually with narrow brownish black edges around disc and pelvic fins.

SIZE. To at least 90 cm TL; males usually mature by ~40 cm TL.

HABITAT AND BIOLOGY. Eastern Pacific; Costa Rica to Chile. Demersal and semi-pelagic inshore, and on mid-continental and insular slopes to at least 700 m depth. Feeds mostly on fishes. Otherwise, life history largely unknown.

SIMILAR SPECIES. Possibly very wide ranging in the Pacific but distribution not well defined. An unidentified specimen photographed deep underwater off Hawaii may be this species. Synonyms include *Tetronarce peruana* (Chirichigno), and *T. semipelagica* (Parin & Kotlyar) and *T. microdiscus* (Parin & Kotlyar).

ADEN TORPEDO

18.9

Torpedo adenensis Carvalho, Stehmann & Manilo, 2002

NT

IDENTIFICATION. Small to medium-sized torpedo ray, with a distinctive reddish or orange-brown dorsal colour, without distinctive spots or dorsal markings, and few knob-like spiracular papillae. Disc broad, slightly wider than long, widest at its anterior third; anterior margin almost straight with a median protuberance. Eyes slightly smaller than spiracles. Spiracles large and rounded, with slightly elevated rims; 3–8 knob-like, somewhat inconspicuous papillae on outer and posterior margins. Nostrils large, round, with well-defined nasal flaps. Mouth weakly arched; teeth small and sharp, in up to 47 upper and 39 lower rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins rounded posteriorly, but not exceedingly broad. Dorsal fins rounded at apices; second dorsal fin more slanted and much smaller than first. First dorsal situated almost entirely over posterior pelvic fins; second dorsal at mid-tail length as measured from ends of pelvic fins. Tail somewhat short and stout with a low skin fold. Upper lobe of caudal fin slightly more sloping than lower lobe; posterior margin of fin straight to rounded.

COLOUR. Reddish brown or orange-brown above, without distinctive markings; posterior margins of dorsal and caudal fins creamish. Ventrally creamy white, with orange or greyish pectoral and pelvic-fin margins; darker blotches sometimes present on ventral tail.

SIZE. Reaches ~41 cm TL; adult males reported at 39 cm TL and still adolescent at 28 cm TL.

HABITAT AND BIOLOGY. North-West Indian Ocean; Gulf of Aden. Poorly known, described from 5 specimens collected near the Yemen coastline at 25–140 m deep. No biological information exists.

SIMILAR SPECIES. No other *Torpedo* has a uniform orange-brown or reddish brown dorsal coloration. In the North-West Indian Ocean and associated gulfs, other species of *Torpedo* typically have ornate dorsal colour patterns consisting of spots, blotches and vermiculations.

CARIBBEAN TORPEDO

18.10

Torpedo andersoni Bullis, 1962

DD

IDENTIFICATION. Small torpedo ray with a tall first dorsal fin, and upper surface brownish with distinctive orange-brown spots. Disc broad, wider than long, widest at its anterior third; anterior margin relatively straight but with a slight median protuberance. Eyes slightly larger than spiracles, both moderately large, separated by a small space. Spiracles moderately large, rounded; 1 or very few discernible, inconspicuous papillae at posterior margin. Nostrils small, circular, with well-defined nasal flaps. Mouth arched, teeth in up to 16 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins rounded posteriorly, but not exceedingly broad. Dorsal fins rounded to oval at apex; second dorsal fin more slanted and much smaller than unusually large first dorsal. First dorsal fin situated entirely over posterior pelvic fins; second centred at about mid-tail length as measured from ends of pelvic fins. Tail very short and stout; lateral skin fold moderately developed. Upper lobe of caudal fin often more oblique than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to weakly convex.

COLOUR. Brown to yellowish brown above, with small, darker, orange-brown spots or blotches forming an irregular, mottled pattern on disc, tail, and pelvic, dorsal and caudal fins. Ventral surface creamy white.

SIZE. Reaches at least 22 cm TL (an adult male); smallest specimens ~15 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Florida Straits and off Nicaragua. Smallest torpedo ray, known from few specimens and a handful of sightings. Occupies a wide depth range, inshore to 10 m depth in coral-reef habitats as well as offshore to 230 m on the upper continental slope. Biology unknown.

SIMILAR SPECIES. This rarely seen species is the only torpedo ray in the Western Atlantic with spiracular papillae, mottled dorsal coloration and a small maximum size.

ROSETTE TORPEDO

18.11

Torpedo bauchotae Cadenat, Capapé & Desoutter, 1978

DD

IDENTIFICATION. Medium-sized torpedo ray, with an elaborate pattern of rosettes, ocelli and reticulations over dorsal disc and tail. Disc fleshy and very thick, circular; about as broad as long, widest slightly anterior to mid-disc; anterior margin broadly rounded to straight, with weak median protuberance; snout very short. Eyes bulging, separated from spiracles by a small space; orbit slightly larger than spiracles, size similar to interspiracular distance. Spiracles rounded, with 9–11 small tentacles or knob-like papillae. Nostrils with well-defined nasal flaps. Mouth arched, teeth in up to 24 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins broad, rounded posteriorly. Dorsal fins rounded to oval at apex; first dorsal fin broad, second dorsal more slender; first dorsal slightly taller than second; second dorsal with more slanted anterior margin. First dorsal fin situated entirely over pelvic fins; dorsal fins separated by shorter than base length of first; distance between second dorsal and caudal fin larger than interdorsal distance. Tail very short and stout, lateral skin fold moderately developed. Upper lobe of caudal fin larger and slightly more sloping than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to rounded slightly.

COLOUR. Brownish above, densely covered on disc and tail with numerous darker brown to purplish rosettes formed from clusters of small dark spots; bands of smaller whitish median spots present on outer disc and fins; clusters defined by an elaborate reticulate pattern. Ventral surface creamy white.

SIZE. Reaches ~60 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Senegal to Angola. Uncommon, known from few specimens. Occurs inshore in shallow water, also deeper on continental shelf to 60 m deep.

SIMILAR SPECIES. Somewhat similar in shape to the Marbled Torpedo (18.14), but easily distinguished from it and all other torpedo rays by its intricate colour pattern, and disc and fin proportions.

BLACKSPOTTED TORPEDO

18.12

Torpedo fuscomaculata Peters, 1855

DD

IDENTIFICATION. Medium-sized torpedo ray with a highly variable but distinctive marbled colour pattern. Disc fleshy and thick, circular; about as broad as long, widest slightly anterior to mid-disc; anterior margin straight with a slight median protuberance; snout very short. Eyes small, slightly bulging, eyes and spiracles separated by a small space, and eyes closer to spiracles than to snout anterior margin; orbit smaller than interspiracular space, slightly larger than spiracles. Spiracles rounded, with up to 7 short papillae; posterior papilla longest. Nostrils with well-defined nasal flaps. Mouth arched, teeth in up to 50 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins broad, rounded posteriorly. Dorsal fins rounded to oval at apex. First dorsal broad, slightly taller than second; second dorsal more slender than first dorsal and more slanted anteriorly. First dorsal situated entirely over pelvic fins. Tail very short and stout; lateral skin fold moderately developed. Upper lobe of caudal fin larger and slightly more sloping than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to rounded slightly.

COLOUR. Highly variable, greyish, yellowish or reddish brown above, usually with numerous darker spots and blotches each smaller than interorbital space in size; sometimes with lighter outer rings forming ocelli; blotches may form irregular reticulate pattern; margins of dorsal and caudal fins sometimes lightly coloured. Undersurface creamy white.

SIZE. Reaches ~65 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; Tanzania to South Africa, including offshore islands. Widespread in continental and insular habitats at depths to 440 m, but commonly shallower than 50 m. Enters estuaries in South Africa during periods of high salinity. Young reported to be born in the summer. Feeds on a variety of fishes and cuttlefishes. Frequent accidental catch of anglers.

SIMILAR SPECIES. Distinct from other torpedo rays of the Western Indian Ocean in colour pattern. However, coloration is highly variable between populations and regional forms may form part of a species complex.

WEST AFRICAN TORPEDO

18.13

Torpedo mackayana Metzelaar, 1919

DD

IDENTIFICATION. Small to medium-sized torpedo ray, with a distinctive rusty brown upper surface with numerous small, whitish spots, and lacking spiracular papillae. Disc rather fleshy and thick, circular, slightly broader than long, widest slightly anterior to mid-disc; anterior margin almost straight, sometimes with a small median bulge at tip; snout rather short. Eyes not bulging prominently, eyes and spiracles well separated; orbit about same size as spiracles but smaller than interspiracular distance. Spiracles rounded, without papillae of any kind. Nostrils with well-defined nasal flaps. Mouth arched, teeth in up to 38 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins not excessively broad, with more or less straight outer margins. First dorsal usually with a broadly oval to rounded apex; situated well posteriorly, over posterior pelvic fins. Second dorsal more slender, slightly smaller than first dorsal, more slanted anteriorly, and with a slightly more oval apex. Tail elongate and moderately stout; lateral skin fold only moderately developed. Upper lobe of caudal fin slightly larger and more sloping than lower lobe; both upper and lower apices rounded to oval; lower lobe curved; posterior margin of fin straight to rounded slightly.

COLOUR. Greyish brown to rusty brown above, with small, scattered white spots sometimes forming small ocelli; spots vary from very numerous and closely packed to sparse, and from very small to about equal to eye diameter in size. Ventral surface creamy white.

SIZE. Reaches 40 cm TL; males mature at ~32 cm TL, females to ~35 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Senegal to Angola. Continental shelf in shallow water, 15–50 m deep. Presumably eats small invertebrates and fishes. Biology largely unknown.

SIMILAR SPECIES. A distinctive species, being the only member of the genus *Torpedo* with smooth-edged spiracles.

MARBLED TORPEDO

18.14

Torpedo marmorata Risso, 1810

DD

IDENTIFICATION. Medium-sized to large torpedo ray, with a distinctive light reticular coloration, and usually with long spiracular papillae. Disc fleshy and very thick, circular, about as broad as long, widest at about mid-disc; anterior margin almost straight, sometimes with a small median bulge; snout short. Eyes bulging, eyes and spiracles well separated; orbit slightly larger than spiracles, size greater than interspiracular distance. Spiracles rounded, usually with 6–9 tentacle-like papillae that extend to centre of spiracular opening. Nostrils with well-defined nasal flaps. Mouth arched, teeth in up to 26 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins extending posteriorly in a more or less straight fashion, rounded posteriorly. First dorsal usually with a broadly rounded apex, situated entirely over pelvic fins. Second dorsal more slender, not as tall as first dorsal, more slanted anteriorly, and with an oval apex. Tail short and moderately stout; lateral skin fold developed. Upper lobe of caudal fin slightly larger and more sloping than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to rounded slightly.

COLOUR. Dark brown to greyish brown above, with a complex and variable pattern of paler blotches or fine reticulations; sometimes with dense pattern of brownish black and white spots and blotches. Ventral surface creamy white.

SIZE. Reaches 100 cm TL, but more usually to 60 cm TL. Males mature at ~30 cm TL, females at ~40 cm TL, born at 10–14 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic Ocean and Mediterranean Sea; widespread. Benthic on continental shelf and slope from nearshore to at least 370 m deep. Produces large litters of 2–32 pups after a 10-month gestation. Feeds on benthic invertebrates and fishes. Its electric shock is powerful.

SIMILAR SPECIES. Shares with the Rosette Torpedo (18.11) a complex pattern of pale spots and blotches but in *T. marmorata* these markings are never organised to form distinct rosettes.

PANTHER TORPEDO

18.15

Torpedo panthera von Olfers, 1831

DD

IDENTIFICATION. Medium-sized torpedo ray, with distinctive pattern of small white spots, not clustered and smaller than eye, over a brown to reddish brown upper surface, and usually with a long posterior spiracular papilla. Disc fleshy, broadly circular, slightly wider than long, widest near mid-disc; anterior margin straight, median bulge usually inconspicuous; snout short. Eyes moderately sized, eyes and spiracles separated by a considerable space; orbit smaller than interspiracular distance, about equal to spiracle in size. Spiracles rounded, usually with 7 short papillae that do not extend to centre of spiracular opening; lateral papillae small, posterior papilla elongate. Mouth arched. Nostrils with well-defined nasal flaps. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins broad and not noticeably elongate, rounded posteriorly. First dorsal with very broadly rounded apex, situated entirely over pelvic fins. Second dorsal fin smaller than first dorsal, more slender and slanted anteriorly, with an oval apex; second dorsal originates over pelvic-fin posterior tip. Distance between second dorsal and caudal fin about equal to distance between dorsal fins. Tail short and moderately stout; skin folds rather well developed. Upper lobe of caudal fin larger and more sloping than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to rounded.

COLOUR. Pale brownish to reddish brown above, overlain with a complex pattern of irregular, white, diffuse-edged markings; white markings not clustered, smaller than eye. Ventral surface creamy white.

SIZE. Attains 60 cm TL (reports to 100 cm TL need verifying); males mature by 28 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; Red Sea to eastern India. Benthic, mainly in shallow water on continental shelf, but reported from 350 m depth in the Gulf of Aqaba. Possibly more widespread in the region. Lives on coral reefs, as well as over sandy to rocky bottoms. Feeds on invertebrates and small reef fishes.

SIMILAR SPECIES. Often confused with the Persian Gulf Torpedo (18.16), but distinguished by colour pattern.

PERSIAN GULF TORPEDO

18.16

Torpedo sinuspersici von Olfers, 1831

DD

IDENTIFICATION. Medium-sized to large torpedo ray, with an elaborate reticulate dorsal coloration. Disc fleshy, broadly circular, slightly wider than long, widest at about mid-disc; anterior margin almost straight with small median bulge at tip. Eyes moderately sized, eyes and spiracles separated by considerable space; orbit smaller than interspiracular distance, about equal to spiracle in size. Spiracles rounded, usually with 9–10 rather short, subtriangular papillae that do not extend to centre of spiracle opening; lateral papillae smaller, posterior papilla more elongate. Mouth arched. Nostrils with large nasal flaps. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins broad and not very elongate, rounded posteriorly. First dorsal with very broadly rounded apex, not as tall as caudal fin, situated entirely over pelvic fins. Second dorsal fin smaller than first dorsal, more slender, and anteriorly slanted with oval apex; second dorsal originates over pelvic-fin posterior tip. Distance between second dorsal and caudal fin usually larger than between dorsal fins. Tail short and moderately stout; skin folds rather well developed. Upper lobe of caudal fin larger and more sloping than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to rounded.

COLOUR. Dorsally highly variable, adults usually brownish or blackish brown, covered with highly elaborate pale reticulate pattern (formed by fused spots); young specimens sometimes sparsely covered with white spots. Ventrally mostly creamy white.

SIZE. Attains 80 cm TL, but reported to ~130 cm TL; males reach adulthood smaller than 30 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; South Africa to Persian Gulf. Benthic on continental shelf to 150 m depth. Occurs on coral reefs, including sandy and rocky bottoms. Feeds on benthic invertebrates and fishes.

SIMILAR SPECIES. Highly variable and confused with the Panther Torpedo (18.15). Their colorations are distinct with the Persian Gulf Torpedo having a more reticulate pattern. Possibly a species complex.

RED SEA TORPEDO 18.17

Torpedo suessi Steindachner, 1898

DD

IDENTIFICATION. Small torpedo ray, adults with a slender reticulate pattern and large circular spots dorsally on disc. Disc fleshy, broadly circular, slightly wider than long, widest at near mid-disc; anterior margin almost straight with a very small median bulge at tip. Eyes moderately large, almost equally distant from anterior snout margin and spiracles; orbit smaller than interspiracular distance, slightly larger than spiracles. Spiracles rounded, usually with a few short lateral papillae (not extending to centre of spiracular opening); posterior and central papilla elongate. Mouth arched. Nostrils with well-defined nasal flaps. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins rather broad, not very elongate, rounded posteriorly. First dorsal with a very broadly rounded apex, similar to caudal fin in height, situated entirely over pelvic fins. Second dorsal fin smaller than first, more slender and anteriorly slanted, with an oval apex; second dorsal originates over pelvic-fin posterior tip. Tail short and moderately stout; skin folds developed. Upper lobe of caudal fin larger and more sloping than lower lobe; both upper and lower apices rounded to oval; posterior margin of fin straight to rounded.

COLOUR. Brownish to light reddish brown above on disc with a darker reticulate pattern surrounding 8 large (width exceeding interorbital space), irregular, dark brown spots with lighter margins. Ventral surface creamy white.

SIZE. Attains at least 30 cm TL, but probably reaches ~40 cm TL; males reach adulthood before 23 cm TL.

HABITAT AND BIOLOGY. North-West Indian Ocean; Red Sea, off Yemen and possibly Sudan. Poorly understood, nothing about its biology known.

SIMILAR SPECIES. Most similar to Panther Torpedo (18.15) in body proportions and overall shape, these species differ mostly in colour pattern. The Red Sea Torpedo has large spots but these do not form distinct ocelli.

OCELLATE TORPEDO

18.18

Torpedo torpedo (Linnaeus, 1758)

DD

IDENTIFICATION. Medium-sized torpedo ray, with a distinctive dorsal colour with bluish-centred ocelli with slender black ring and broad whitish outer ring, as well as small white spots. Disc fleshy and thick, circular, slightly broader than long, widest slightly anterior to mid-disc; anterior margin broadly rounded to straight, with a median protuberance. Eyes slightly bulging, slightly larger or about equal to spiracles; eyes and spiracles separated by a small space. Spiracles rounded, with 8–10 small triangular papillae. Mouth arched; nostrils with moderate nasal flaps; teeth in up to 34 rows. Electric organs more clearly visible in ventral than dorsal view. Pelvic fins somewhat slender, elongate, and rounded posteriorly. First dorsal fin broad with rounded apex; second dorsal more slender, with oval apex; first dorsal more broad and slightly taller than second; second dorsal has more slanted anterior margin. First dorsal situated entirely over pelvic fins. Tail somewhat slender and long posterior to pelvic fins; lateral skin fold moderately developed. Upper lobe of caudal fin larger and slightly more sloping than lower lobe; upper apex oval, lower apex more broad, rounded; posterior margin of caudal fin usually straight or weakly rounded.

COLOUR. Pale brown, tan or reddish brown above, with 2–7 (usually 5, sometimes none) symmetrically positioned pectoral ocelli; ocelli with blue centres surrounded by a darker ring, and a lighter, broader, outer ring; usually with smaller white spots scattered on disc and pelvic fins. Ventral surface off-white to dusky grey.

SIZE. Reaches 60 cm TL; born at ~9 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic; Bay of Biscay to Angola, including the Mediterranean Sea. Benthic in shallow waters on continental shelf to ~70 m deep. Feeds on benthic invertebrates and smaller fishes. Litters often large (up to 21 pups).

SIMILAR SPECIES. Colour pattern is unique within the family. Occasionally lacks ocelli, but this torpedo is easily identified by a reddish or brownish dorsal coloration, long tail, and unique fin proportions.

19

SKATES

Family Rajidae

P.R. Last, B. Séret, M.F.W. Stehmann & S. Weigmann

Members of the family Rajidae, known as skates or hardnose skates, are small to very large rays (adults 33 cm to more than 2 m TL) with a depressed body, almost circular to rhombic disc, and pectoral-fin apices broadly rounded to angular. A firm, slender tail is well demarcated from the disc. The snout is more or less elongated and pointed, supported by a stiff rostral cartilage, and often has a short lobe at its tip. The anterior nasal flaps are expanded to form an incomplete nasal curtain. These flaps usually reach the mouth but their posterior margins are not joined like in some other ray groups, such as the stingrays. Pelvic fins are notched with distinct anterior and usually larger posterior lobes. Two small dorsal fins are located near the end of the tail and their bases are often joined. The caudal fin is greatly reduced in size with the lower lobe (when present) smaller than the upper lobe. The skin is sometimes naked, but the disc and tail are usually partly covered with dermal denticle patches, particularly along the anterior disc margins. Thorns, usually present on the upper disc of juveniles (and most adults), are variably located on the orbital rims (around upper half of eye), nuchal (nape) and scapular (shoulder) regions, and along the median disc and tail (additional lateral thorn rows on the tail of several species). Adult males have a well-defined, longitudinally arranged patch of retractable alar thorns on the mid-outer regions of each pectoral fin, and some species have additional anteriorly positioned thorn patches, known as malar thorns. The family includes at least 154 valid described species in 17 genera: *Amblyraja*, *Beringraja*, *Breviraja*, *Dactylobatus*, *Dentiraja*, *Dipturus*, *Hongeo*, *Leucoraja*, *Malacoraja*, *Neoraja*, *Okamejei*, *Orbiraja*, *Raja*, *Rajella*, *Rostroraja*, *Spiniraja* and *Zearaja*. However, several unnamed genera and species are known to exist, and some species are likely to be re-assigned to other genera. Specialised skeletal features, particularly those of the clasper cartilages, are important in distinguishing genera and species. The rostral cartilage varies from being moderately slender to stiff and stout from its base to the snout tip (except in *Breviraja*), and its base extends anteriorly to, or noticeably forward of, the leading edges of the nasal capsules. The anteriormost part of pectoral-fin skeleton is well separated from the tip of snout (by a semi-translucent area, except in *Breviraja*), and the ventral terminal cartilage of the clasper has a characteristic sharp, lateral edge forming an external component, the shield (see Glossary). Most skates are demersal in cold water on continental slopes and abyssal plains to depths of more than 4000 m, but some temperate and polar species occur inshore on continental shelves, and 1 lives primarily in brackish/freshwater habitats. The group is cosmopolitan with representatives in all oceans. Some larger, more mobile benthopelagic species are wide-ranging, but most are primarily benthic with restricted distributions, often within small geographical confines. Skates are mainly carnivorous, feeding on benthic invertebrates (i.e. crustaceans, polychaetes, bivalve molluscs, and cephalopods) and fishes living on or in sediments of the seafloor. All species are oviparous, with females laying their eggs in cases (also known as mermaid's purses). Egg cases are rectangular and flattened in shape with a tough protective outer coating of keratin, and often a horny structure at each corner. Embryos develop slowly, taking up to 2 years to hatch. Skates are caught worldwide, mainly as bycatch of trawl fisheries. The flesh is edible and some species are retained as food for humans.

KEY TO RAJID GENERA

The hardnose skates are very difficult to characterise based solely on external features because skeletal structures, particularly of the claspers, are more important in distinguishing groups. The following key is incomplete; clearly separating some genera but failing to distinguish others. For example, genera in couplet 14 could not be distinguished so readers need to use distributional ranges (which largely do not overlap) to help identify species. Where a specimen fails to key out correctly, we suggest proceeding again using the alterative option in couplets. The key below has incorporated some technical characters in order to distinguish between genera (see the Glossary for further explanation).

1. Anterior margin of snout very obtuse (fig. 1); anterolateral margin of ventral disc with band of claw-like denticles (fig. 2); Western Atlantic .... ***Dactylobatus*** **(2 species; fig. 1, pp. 229–230)**

   Anterior margin of snout somewhat obtuse (fig. 7) to acute (fig. 10); no enlarged claw-like denticles on anterolateral margin of ventral disc **2**

2. Anteriormost extension of pectoral-fin skeleton abutting or nearly abutting tip of snout, not separated from snout by largely translucent area (fig. 3); tip of snout pliable **3**

   Anteriormost extension of pectoral-fin skeleton distinctly separated from tip of snout by semi-translucent area (fig. 4); tip of snout rather firm and not pliable **4**

3. Triangular patch of thorns present on nuchal and shoulder region (fig. 7); length of anterior pelvic-fin lobe 65–80% of posterior lobe (fig. 5); tail width at base slightly greater than orbit diameter; Western Atlantic .... ***Breviraja*** **(5 species; fig. 7, pp. 224–228)**

   No triangular patch of thorns on nuchal and shoulder region (nuchal thorns and 1 or 2 scapular thorns are sometimes present, but these do not form a distinct triangular patch) (fig. 8); length of anterior pelvic-fin lobe 80–100% of posterior lobe (fig. 6); tail width at base less than orbit diameter; Eastern and North-West Atlantic .... ***Neoraja*** **(5 species; fig. 8, pp. 297–301)**

fig. 1

fig. 2

fig. 3 fig. 4

skeleton of head

fig. 5 fig. 6

fig. 7

fig. 8

4. Upper disc with 2 prominent pairs of dark pectoral markings with undulate edges (fig. 9); North-West Pacific .... ***Hongeo*** **(1 species; fig. 9, p. 279)**

   Upper disc without pectoral markings, or if present only 1 pair prominent 6

5. Distal quarter to third of tail without distinct thorns, instead uniformly covered with small denticles (fig. 13); Eastern and North-West Atlantic .... ***Malacoraja*** **(4 species; fig. 10, pp. 293–296)**

   Distal third to quarter of tail with distinct thorns, similar to those on anterior tail (fig. 14) 7

6. Sensory pores and often canals on ventral surface of disc darkly pigmented (fig. 12), most obvious on head (except in Australian *Okamejei*) 5

   Sensory pores and canals on ventral surface of disc not darkly pigmented (pores not strikingly obvious) 10

7. Typically large skates with an elongate to very elongate snout (fig. 11); internarial width usually less than 60% of distance from tip of snout to anterior margin of nostril in adults; end of clasper narrowly rounded or pointed; cosmopolitan .... ***Dipturus*** **(41 species; fig. 11, pp. 241–278)**

   Typically small to medium-sized skates with a short (fig. 16) to elongate (fig. 15) snout; internarial width usually exceeding 60% of distance from tip of snout to anterior margin of nostril in adults; end of clasper narrowly rounded, pointed, or flattened and spatula-like 8

fig. 9

fig. 10

fig. 11

fig. 12

ventral head

fig. 13

fig. 14

rear of tail

8. Snout long and narrowly pointed (fig. 15); end of greatly enlarged clasper flattened and spatula-like (fig. 18); temperate South Pacific and South-West Atlantic .... ***Zearaja*** **(4 species; fig. 15, pp. 360–363)**

   Snout short to moderately elongate; end of moderately large clasper narrowly rounded (fig. 19) or pointed (fig. 20) 9

9. Long interdorsal and postdorsal tail sections (fig. 16); end of clasper in all species, except *O. ornata,* with small soft spiny structure near its tip (component funnel) (fig. 22); Indo–West Pacific .... ***Okamejei*** **(in part, 12 species; fig. 16, pp. 302–313)**

   Short interdorsal and postdorsal tail sections (fig. 17); clasper without component funnel; Australia .... ***Dentiraja*** **(in part, 8 species; fig. 17, pp. 231–240)**

10. Median thorns on disc very large and with stellate bases (fig. 23); end of massive, broad clasper club-shaped and widened (fig. 21); cosmopolitan .... ***Amblyraja*** **(8 species; fig. 25, pp. 210–217)**

    Median thorns on disc (if present) small to moderate in size and without stellate bases (fig. 24); end of clasper narrowly rounded (fig. 19) or pointed (fig. 20) 11

spatula-like
fig. 18

narrowly rounded
fig. 19

pointed
fig. 20

club-shaped
fig. 21

shapes of right clasper

clasper glans
funnel
fig. 22

fig. 23

side view of median thorns

fig. 24

fig. 15

fig. 16

fig. 17

fig. 25

11. Triangular patch of thorns present over nuchal and shoulder regions (figs 26, 27) (except *Rajella bathyphila* and *R. paucispinosa*) 12

    No triangular patch of thorns on nuchal and shoulder regions (a few nuchal thorns and 1 or 2 scapular thorns are present in some species of *Raja* but do not form an obvious triangular patch) 13

12. Clasper lacking external components, the promontory and roll; 1 to several rows of similar-sized thorns along median disc and tail in both juveniles and adults (fig. 26), but median row reduced in large adults of some species; cosmopolitan .... ***Rajella* (18 species; fig. 26, pp. 333–350)**

    Clasper with external components, the promontory and roll (fig. 29); several rows of thorns along median disc and tail, with mid-row typically smaller than lateral row(s) to completely reduced in adults (simultaneously parallel row thorns become larger) (fig. 27); Atlantic and Indian Oceans .... ***Leucoraja* (13 species; figs 27, 28, pp. 280–292)**

13. No orbital thorns; tail short and very depressed (fig. 30); row of long laterally directed thorns on each side of tail beside lateral folds (fig. 30); southern Australia .... ***Spiniraja* (1 species; fig. 30, p. 359)**

    Orbital thorns present (fig. 32); tail shape and thorns not as above 14

fig. 26

fig. 27

fig. 28

fig. 29
clasper glans

fig. 30

14. Following genera confined to the following geographic regions:

Small skates; snout very short and broad; ventral tip of snout with prominent black blotch; tail short, broad and very depressed; Australia .... ***Dentiraja*** **(in part, 2 species; fig. 31, pp. 236, 238)**

Small skates; snout narrowly angular; no black blotch on ventral tip of snout; tail elongate and very slender; Australia .... ***Okamejei*** **(in part, 2 species; fig. 32, pp. 303, 309)**

Small skates; snout moderately elongate and angular; pectoral marking present and larger than eye; Northern Indian Ocean and Western Central Pacific .... ***Orbiraja*** **(3 species; fig. 33, pp. 314–316)**

Small to large skates; snout very short and broad; tail moderately long and slender; Eastern Atlantic and Western Indian Oceans .... ***Raja*** **(16 species; fig. 34, pp. 317–332)**

Variable group of small to very large skates; snout broadly angular, often with extended tip; pectoral marking usually present; Eastern Pacific, Atlantic and Western Indian Oceans .... ***Rostroraja*** **(8 species; fig. 35, pp. 351–358)**

Variable group of small to very large skates; snout angular or obtuse; tail rather short; North Pacific .... ***Beringraja*** **(6 species; fig. 36, pp. 218–223)**

fig. 31

fig. 32

fig. 33

fig. 34

fig. 35

fig. 36

SOUTHERN THORNY SKATE

19.1

Amblyraja doellojuradoi (Pozzi, 1935)

LC

IDENTIFICATION. Medium-sized skate with a weakly rhombic disc (width ~1.3 times length), snout short and stiff with firm rostral cartilage, medium-sized eyes, prominent thorns on disc, tail short (~72% of precloacal length in adults), and upper disc much darker than undersurface. Disc rather thick, somewhat flabby, anterior margin weakly undulate (strongly so in adult males); apex abruptly angular. Head broad; snout length ~2.3 times and interorbital space subequal to orbit length respectively; snout tip projecting forward slightly as broad, bluntly rounded lobe. Mouth wide; tooth rows in upper jaw ~30–38. Skin of upper surface rough, covered with coarse denticles; ventral surface smooth. Thorns on upper disc massive, more enlarged in young than adults; usually 3 pairs near eyes, 1–2 on nape, 2–3 on each shoulder; median row of 12–15 from shoulder to first dorsal fin; malar thorns well developed; none interdorsally; scattered thornlets on snout and pectoral fins. Tail rather robust, tapering from base to tip; lateral folds extend along most of tail. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, separated slightly; caudal fin very small. Clasper of adult male very broad but clearly not reaching first dorsal fin.

COLOUR. Medium to dark brown above, with indistinct pattern of scattered darker spots and blotches; usually with pair of large pale blotches near front of eyes and at pectoral axils. Undersurface predominantly whitish, often with some grey specks and spots on disc and tail.

SIZE. Attains ~69 cm TL. Hatches from egg case at ~9 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic and South-East Pacific; Uruguay to southern Chile, including Falkland Islands. Primarily on mid- and outer continental shelf and upper slope at 50–640 m depths, occasionally caught deeper (to 1000 m). Feeds on benthic invertebrates and small bony fishes.

SIMILAR SPECIES. Other species of *Amblyraja* in the region are either almost entirely dark on both disc surfaces or have dark blotches on the undersurface. Validity of this species has been confirmed by molecular data, but the taxonomy of some other species in the genus needs further investigation.

THICKBODY SKATE

19.2

Amblyraja frerichsi (Krefft, 1968)

DD

IDENTIFICATION. Medium-sized, heavy-bodied skate with a very rough rhombic disc (width ~1.3 times length), snout short and stiff with firm rostral cartilage, small eyes, highly prominent thorns and thornlets on disc, tail short (~77% of precloacal length in adults), and both surfaces of disc dark. Disc very thick, somewhat flabby, anterior margin deeply concave or weakly undulate (strongly so in adult males); apex narrowly rounded to angular. Head broad; snout length ~3.7 and interorbital space ~2 times orbit length respectively; snout tip projecting forward as narrow, bluntly rounded lobe. Mouth wide; tooth rows in upper jaw 38–48. Skin of upper surface covered with coarse denticles; ventral surface smooth. Thorns on upper disc enlarged; 3 pairs near eyes, 1–2 on nape, 2–3 on each shoulder; 18–26 in median row from mid-shoulder to first dorsal fin; 0–2 thornlets interdorsally; dense coverage of large, stellate-based thornlets on pectoral-fin bases and in median band along disc and tail in adults. Tail narrow, stiffened, tapering gradually from base to tip; lateral folds extend along most of tail. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, joined or separated slightly; caudal fin very small. Clasper of adult male with blunt tip, reaching to about middle of tail.

COLOUR. Upper surface dark brown or greyish, usually with darker blotches and spots; tail and edges of dorsal fins dark. Uniformly dark brown or greyish ventrally; young often largely white between head and belly.

SIZE. Attains at least 91 cm TL; reports to 176 cm TL possibly erroneous. Males mature from ~76 cm TL; young hatch at ~22 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic (Uruguay and Argentina), and possibly South-East Pacific (off Chile). Demersal on continental slope and upper abyssal plain at 600–2610 m depths. Diet consists of small benthic invertebrates, adults possibly piscivorous.

SIMILAR SPECIES. In South American waters, most other *Amblyraja* are largely white underneath. The Antarctic Starry Skate (19.3) has dark brown disc edges and large dark blotches on a white undersurface.

ANTARCTIC STARRY SKATE

19.3

Amblyraja georgiana (Norman, 1938)

DD

IDENTIFICATION. Large, heavy-bodied skate with a very rough rhombic disc (width 1.3 or more times length), snout short and stiff with firm rostral cartilage, small eyes, prominent thorns on disc, tail short (~80% of precloacal length in adults), upper surface with blotches and reticulations, and undersurface largely white. Disc broad, thick, anterior margin strongly concave or weakly undulate (strongly so in adult males); apex abruptly angular. Head broad; snout length ~3.5 times and interorbital space about twice orbit length respectively; snout tip projecting forward slightly as bluntly rounded lobe. Mouth wide; tooth rows in upper jaw 33–44. Skin of upper surface rough, covered with coarse denticles; ventral surface mostly smooth, sometimes with prickles on snout of large females. Thorns usually in 3 pairs near eyes, 1–2 on nape, 2–3 on each shoulder; median row of 20–28 from shoulder to first dorsal fin; often a thornlet interdorsally; scattered thornlets on snout and pectoral fins, and bands of large thornlets on either side of median thorns. Tail tapering gradually from base to tip; lateral folds well-developed posteriorly. Pelvic-fin anterior lobe slightly shorter than posterior lobe. Dorsal fins small, joined or separated slightly; caudal fin rudimentary. Clasper of adult male large, but clearly not reaching first dorsal fin.

COLOUR. Dark brownish to greyish brown above, either plain or with dense reticulate pattern; juveniles reticulated or pale spotted. Undersurface mainly white, outer margins of disc and pelvic fins usually darker speckled or blotched; tail white, speckled or with brown median stripe.

SIZE. Attains ~115 cm TL. Matures at 80–90 cm TL; hatches at ~20 cm TL.

HABITAT AND BIOLOGY. Southern Ocean and South Atlantic (off South America and nearby islands). Demersal on continental and insular shelves and upper slopes, mainly at 20–350 m depths (rarely to 1255 m). Feeds on small benthic invertebrates.

SIMILAR SPECIES. A congener found in deeper water off South Georgia Island may be the Boreal Skate (19.4). Records from the Indian Ocean and parts of the Southern Ocean need confirmation.

BOREAL SKATE

19.4

Amblyraja hyperborea (Collett, 1879)

LC

IDENTIFICATION. Large, heavy-bodied skate with a rough rhombic disc (width 1.2–1.3 times length), snout short and stiff with firm rostral cartilage, rather small eyes, prominent thorns on disc, tail very short (~64% of precloacal length in adults), and both surfaces of disc dark or irregularly blotched. Disc very thick, somewhat flabby, anterior margin weakly undulate (strongly so in adult males); apex abruptly angular. Head broad; snout length 2.9–4.7 and interorbital space 1.6–2.1 times orbit length respectively; snout tip projecting forward as broad, bluntly rounded lobe. Mouth very wide; tooth rows in upper jaw 35–48. Skin of upper surface rough, covered with coarse denticles; ventral surface smooth. Thorns on upper disc more enlarged in young; usually 3 pairs near eyes, 1–2 on nape, 2–3 on each shoulder; median row of 22–32 from shoulder to first dorsal fin; often a thornlet interdorsally; scattered thornlets on snout and pectoral fins. Tail narrow, tapering from base to tip; lateral folds extend nearly entire length of tail. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, separated slightly; caudal fin very small. Clasper of adult male very large, almost reaching first dorsal fin.

COLOUR. Dark grey or brownish above with darker, diffuse blotches, often with indistinct light spots. Undersurface of adult disc greyish or blotched, often whitish on snout and belly; young variable, dark or largely pale. Tail similar to body, often with dark blotches or bands.

SIZE. Attains ~112 cm TL. Matures at 80–90 cm TL, hatching size 16–18 cm TL.

HABITAT AND BIOLOGY. Cosmopolitan; widespread, primarily in high latitudes, in most regions. Demersal, deepwater on continental and insular slopes at 165–3165 m depths, probably most common on deep slopes and at abyssal depths. Diet consists of small benthic invertebrates and fishes.

SIMILAR SPECIES. Molecular data has confirmed that this skate is more widespread than first thought. *Amblyraja badia* (North Pacific) and *A. robertsi* (South Atlantic) appear to be variants.

JENSEN'S SKATE

19.5

Amblyraja jenseni (Bigelow & Schroeder, 1950)

LC

IDENTIFICATION. Large skate with a rough rhombic disc (width ~1.2 times length), snout short and stiff with firm rostral cartilage, small eyes, prominent thorns on disc, tail very short (~63% of precloacal length in adults), and both surfaces of disc fully or partly dark. Disc not greatly thickened and rather firm, anterior margin undulate (more so in adult males); apex abruptly angular. Head broad; snout length 3.6–4.5 and interorbital space 1.8–2.2 times orbit length in adults respectively; snout tip projecting forward slightly as broad, bluntly rounded lobe. Mouth very wide; tooth rows in upper jaw 52–66. Skin of upper surface rough, largely covered with coarse denticles (except on posterior disc); ventral surface smooth. Thorns on upper disc usually in 3–4 pairs near eyes, 2 on nape, 2–4 on each shoulder; median row of 20–31 from shoulder to first dorsal fin; no interdorsal thornlets; sometimes with small thornlets on snout, pectoral fins, and alongside median thorn row on tail. Tail stiffened, narrow, tapering from base to tip; lateral folds extend nearly entire length of tail. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, separated slightly; caudal fin very small. Clasper of adult male very large, almost reaching first dorsal fin.

COLOUR. Greyish or dark brown above, plain or with faint dark blotches and indistinct pale spots. Undersurface usually white on head and belly; cloaca, posterior disc and outer margins of pectoral and pelvic fins usually with broad dark margins in adults. Tail often faintly banded.

SIZE. Attains ~112 cm TL, largest in North-West Atlantic and on Mid-Atlantic Ridge; smaller elsewhere. Males mature at ~83 cm TL.

HABITAT AND BIOLOGY. North Atlantic; New England to British Isles, including Mid-Atlantic Ridge. Demersal mainly on continental and insular slopes at 165–2550 m depths. Feeds on benthic invertebrates and small fishes.

SIMILAR SPECIES. Closely resembles the Boreal Skate (19.4), but appears to have a higher tooth row count (more than 51 *vs.* less than 49 rows). The relationship between these skates requires further investigation as they are most likely the same species.

THORNY SKATE

19.6

Amblyraja radiata (Donovan, 1808)

VU

IDENTIFICATION. Large skate with an extremely rough rhombic disc (width 1.2–1.3 times length), snout short and stiff with firm rostral cartilage, medium-sized eyes, prominent thorns on disc, tail short (~76% of precloacal length in adults), and upper surface darker than lower surface. Disc rather firm, more rounded in females and young; anterior margin undulate (more so in adult males); apex narrowly rounded to abruptly angular. Head broad; snout length 2.8–3 and interorbital space 1.2–1.4 times orbit length respectively; snout tip projecting forward slightly as short rounded lobe. Mouth wide; tooth rows in upper jaw 38–40. Skin of upper surface rough, covered with coarse denticles; ventral surface smooth, snout sometimes prickly. Thorns very large and with stellate bases on anterior disc; usually 3 pairs near eyes, 1–2 on nape, 2–3 on each shoulder; median row of usually 13–17 (possibly 9–34) from shoulder to first dorsal fin; dense median band of large thornlets extends along disc and tail; rarely a thornlet interdorsally. Tail stiff, tapering strongly from base to tip; lateral folds narrow. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins small, joined or rarely separated slightly; caudal fin rudimentary. Clasper of adult male short and extremely broad.

COLOUR. Brownish or greyish brown above, usually clouded with darker and paler blotches; often also with blackish spots forming rosettes. Undersurface white, disc occasionally with dark blotches and greyish margins.

SIZE. Attains ~111 cm TL, but size varies by region and depth. Maturity size varies similarly, from 44–90 cm TL. Young hatch at ~8–12 cm TL.

HABITAT AND BIOLOGY. North Atlantic; widespread in subarctic and cold temperate seas (latitudes above 40°N). Demersal on continental and insular shelves and slopes from nearshore to 1400 m depths, usually at 25–440 m. Preys on benthic invertebrates and small bottom-dwelling fishes.

SIMILAR SPECIES. No other *Amblyraja* species has such low thorn densities, but the dorsal surface is still extremely spiny with large thorns in North Atlantic populations.

REVERSE SKATE

19.7

Amblyraja reversa (Lloyd, 1906)

DD

IDENTIFICATION. Medium-sized skate with a long heart-shaped disc (width ~1.1 times length), moderately elongate snout with firm rostral cartilage, rather small eyes, small thorns on disc, tail elongate (slightly shorter than precloacal length), and ventral surface of disc darker than upper surface. Disc not thickened, anterior margin strongly undulate (in adult male); apex broadly rounded. Snout length ~5.5 times orbit length, interorbital space ~1.7 times orbit length; tip projecting well forward as narrowly rounded lobe. Mouth wide; tooth rows in upper jaw ~42. Skin of upper surface partly covered with fine denticles (over skull but absent from snout); ventral surface smooth. Thorns mostly small; orbit with 3–4 thorns (1 large stellate spine on preorbit, 2–3 smaller thorns behind); 5 thorns in median row on nape; 3 thorn rows on tail, those in lateral rows more numerous than those in median row; no thorns or thornlets interdorsally; well-developed malar patch present beside eye and spiracle in adult male. Tail slender, tapering gradually from base to tip; lateral folds weak. Pelvic-fin anterior lobe long, shorter than posterior lobe. Dorsal fins medium-sized, bases connected; caudal fin rudimentary. Clasper of adult male small, falling well short of first dorsal fin.

COLOUR. Upper surface uniformly white, underneath purplish black.

SIZE. Known only from holotype, a 60 cm TL adult male.

HABITAT AND BIOLOGY. Indian Ocean; Arabian Sea, off Baluchistan. Demersal on continental slope at ~1500 m depth. No other specimens found over the last century and nothing known of its biology.

SIMILAR SPECIES. Only member of this genus reported from the northern Indian Ocean, and no other *Amblyraja* species has a white upper disc with a black ventral surface. Provisionally assigned to *Amblyraja* but this placement may need to be reassessed when more specimens are discovered.

WHITELEG SKATE

19.8

Amblyraja taaf (Meisner, 1987)

DD

IDENTIFICATION. Medium-sized, heavy-bodied skate with a thorny rhombic disc (width ~1.3 times length), snout short and stiff with firm rostral cartilage, rather small eyes, prominent thorns and thornlets on disc, tail short (~80% of precloacal length in adults), pale upper anterior pelvic-fin lobes, and upper disc mostly darker than its undersurface. Disc thickened, anterior margin weakly undulate (strongly so in adult males); apex abruptly angular to rounded slightly. Head broad; snout length ~3.8 and interorbital space ~1.8 times orbit length respectively; snout tip projecting forward as small bluntly rounded lobe. Mouth very wide; tooth rows in upper jaw 29–39. Skin of upper surface very rough, densely covered with coarse denticles; ventral surface smooth, snout sometimes prickly in adults. Thorns usually in 3–4 pairs near eyes, 1–2 on nape, 1–4 (mostly triangle of 3) on each shoulder; median row of 15–21 from shoulder to first dorsal fin; often a thornlet interdorsally; scattered thornlets on snout, pectoral fins, and along sides of trunk and tail. Tail rather broad, stiffened, barely tapering; lateral folds well developed. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins small, joined or separated slightly; caudal fin very small. Clasper of adult male very large, but tip well short of first dorsal fin.

COLOUR. Greyish to brownish above, often with large dark circular blotches; upper anterior pelvic-fin lobe pale greyish to creamy white (or lobe white-edged). Undersurface white, but frequently with dark patches on branchial area, belly, around cloaca, and on pelvic fins and tail.

SIZE. Attains ~90 cm TL. Hatches at ~17 cm TL.

HABITAT AND BIOLOGY. Indian Ocean; Crozet and Kerguelen Islands, possibly off South Africa. Demersal on insular shelves and slopes at 150–600 m depths. Feeds on benthic invertebrates and bony fishes.

SIMILAR SPECIES. Existing records need validating as some are clearly misidentifications of the Boreal Skate (19.4). No other female *Amblyraja* with a dark upper surface are known to have white dorsal anterior pelvic-fin lobes.

BIG SKATE

19.9

Beringraja binoculata (Girard, 1855)

NT

IDENTIFICATION. Very large skate with a wide angular disc (width 1.2–1.4 times length), broadly triangular snout with firm rostral cartilage, small eyes, thorns on head (1–2 nuchal, 3 orbital thorns) and single row of tail thorns in young becoming rudimentary or absent in adults, and upper disc mottled with pair of large pectoral ocelli. Disc anterior margin weakly double concave in adult males, otherwise almost straight; pectoral apices angular. Snout length 5.7–6.6 times orbit length; interorbital space more than twice orbit length. Tooth rows in upper jaw 24–48. Upper surface of disc granular; usually smooth ventrally apart from dense granulations on head and central disc. No scapular thorns. Tail short, mildly depressed and rather slender (length 74–89% of precloacal length), with broad lateral folds, no median bulge; usually with pair of thorns before first dorsal fin. Pelvic fin large, anterior lobe much shorter than posterior lobe, fin margin weakly notched. Dorsal fins broadly rounded, well separated, procaudal length about equal to snout length; caudal fin rudimentary. Predorsal vertebrae ~96.

COLOUR. Variable pattern above; greyish, olive or reddish brown with darker blotches and diffuse-edged white spots; young with very large pectoral ocelli consisting of dark rings, forming blackish blotch surrounded by white spots in adults. Ventral surface whitish, sometimes with dusky blotches and stripe on tail; sensory pores not dark-edged.

SIZE. Attains ~244 cm TL (rarely exceeds 180 cm). Males mature at 100–110 cm TL, females ~130 cm TL; young hatch at 18–23 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; Bering Sea to California (USA). Demersal on continental shelf and slope; most common inshore and mostly shallower than 200 m depth (reported deeper, to 800 m). Produces unusually large egg cases containing multiple embryos.

SIMILAR SPECIES. Closely related to the smaller Mottled Skate (19.12) from the North-West Pacific.

CORTEZ SKATE

19.10

Beringraja cortezensis (McEachran & Miyake, 1988)

DD

IDENTIFICATION. Small skate with a weak rhombic disc (width 1.1–1.2 times length), short and narrowly pointed snout with firm rostral cartilage, large eyes, 2–5 nuchal thorns, 1–3 rows of tail thorns in adult males, rosette of thorns around orbital rim, and brownish upper disc with fine speckling and 2 pairs of weak pectoral ocelli. Disc anterior margin double concave in adult males, otherwise weakly undulate; pectoral apices broadly rounded. Snout length in adults up to 14% TL, 2.3–3 times orbit length; interorbital space narrower than orbit length. Tooth rows in lower jaw 34–37. Disc surface largely smooth; dorsal surface of adult with granulations at snout tip and along most of anterior margin of disc; smooth ventrally apart from dense granulations over snout before nostrils. No lumbar thorns, small malar patch beside eye in mature males. Tail depressed and slender (subequal to precloacal length), with well-developed lateral folds, no median bulge; thorns in staggered median row in males, female unknown. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, well separated, procaudal length about equal to snout length; caudal fin short, very low. Pectoral-fin radials 65–74. Predorsal tail vertebrae ~68.

COLOUR. Brownish with fine light or dark speckling over central disc and tail; usually with large pectoral ocelli formed from dark speckles, and more posterior pair of smaller and darker ocelli with whitish centres; snout pale beside rostral cartilage; dorsal fins with weak pattern. Ventral surface uniformly pale or occasionally with dusky patches on chin; sensory pores dark-edged, not encircled by greyish areas and not reaching pelvic-fin bases.

SIZE. Attains at least 39 cm TL. Males mature at ~34 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; endemic to Gulf of California (Mexico). Demersal on inner continental shelf at ~15–90 m depths. Biology largely unknown.

SIMILAR SPECIES. Closely resembles the California Skate (19.11), but differs in smaller size and in having a shorter snout with eyes closer together.

CALIFORNIA SKATE

19.11

Beringraja inornata (Jordan & Gilbert, 1881)

DD

IDENTIFICATION. Medium-sized skate with a heart-shaped to rhombic disc (width 1.1–1.2 times length), moderate and narrowly pointed snout with firm rostral cartilage, small eyes, up to 11 nuchal thorns, weak orbital thorns, and brownish with ring-like pectoral ocelli and smaller spots on disc. Disc anterior margin weakly double concave in adult males, otherwise undulate; pectoral apices narrowly rounded. Snout length of adults 15–17% TL, 3.3–4.7 times and interorbital space 1.1–1.5 times orbit length respectively. Tooth rows in upper jaw 32–47. Disc smooth above in young; prickles scattered on head and forming long band along entire anterior edge in adults; undersurface largely smooth with denticles confined to anterior margin and becoming more widespread over head in adults. Thorns confined to orbit, nuchal region, and long narrow alar patches in adult males. Tail rather short, convex to depressed (length 0.7–0.8 times precloacal length), not bulging near its mid-length; lateral folds well developed near tail tip; thorns in single, staggered median row in males, large females with 3–5 rows, usually with large paired thorn before first dorsal fin. Pelvic fin large, strongly notched, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, well separated, procaudal length usually slightly less than snout length; caudal fin reduced in size, very low. Pectoral-fin radials mainly 72–78. Predorsal vertebrae ~72.

COLOUR. Dark brown to olive brown above, pectoral ocelli usually present as rings; small ocelli and faint pale spots usually covering disc. Ventral surface pale brown or white; sensory pores dark-edged, sometimes encircled by greyish areas, and not reaching pelvic-fin bases.

SIZE. Reported to 76 cm TL. Males mature at ~47 cm TL, females 52 cm TL; young hatch at ~15–23 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; British Columbia (Canada) to Baja California (Mexico). Demersal inshore from ~15 m to mid-continental slope at 670 m depths. Feeds on small benthic invertebrates, including polychaete worms and shrimps.

SIMILAR SPECIES. The Cortez Skate (19.10) has a shorter snout and narrower interorbital space. Other regional skates have rougher dorsal surfaces and differ markedly in colour pattern.

MOTTLED SKATE

19.12

Beringraja pulchra (Liu, 1932)

VU

IDENTIFICATION. Large skate with a wide angular disc (width ~1.2 times length), small eyes, broadly pointed snout with firm rostral cartilage, 1 nuchal thorn and small rosette of orbital thorns, single thorn row on tail in males and up to 5 rows in females, and upper disc mottled with pair of large pectoral ocelli (most evident in young). Disc anterior margin double concave in adult males, otherwise undulate; pectoral apices abruptly angular. Snout length 5.6–8.5 times orbit length; interorbital space twice orbit or more. Upper surface of head and anterior disc margins granular in adults; largely smooth below, denticles confined to snout tip and sides of snout. No scapular or lumbar thorns. Small malar patch beside each eye. Tail rather short, depressed and tapering (length 0.9–1 in precloacal length), with broad lateral folds, no median bulge. Pelvic fin large, anterior lobe much shorter than posterior lobe, fin margin deeply notched. Dorsal fins broadly rounded, well separated, procaudal length slightly shorter than snout length; caudal fin rudimentary. Predorsal vertebrae ~68–74.

COLOUR. Brown above with darker brown mottling and irregular blotches; pair of large pectoral ocelli generally distinct, consisting of dark rings evident at all stages of growth. Ventral surface whitish, sometimes with darker streaks on tail.

SIZE. Attains ~115 cm TL. Males mature from ~47 cm TL, females ~69 cm TL; young hatch at 9–10 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; China to Sea of Okhotsk, including Taiwan and Japan. Demersal on inner continental shelf; common near coast at depths of 5–30 m, but reports to 700 m probably erroneous. Produces large egg cases with multiple embryos. Eats mainly fishes, crustaceans and cephalopods.

SIMILAR SPECIES. Closest relative of the much larger Big Skate (19.9) from the North-East Pacific but differs in having better-developed thorns on the body of adults and lacking a white-spotted colour pattern. Members of this recently expanded genus are confined to the North Pacific.

LONGNOSE SKATE

19.13

Beringraja rhina (Jordan & Gilbert, 1880)

LC

IDENTIFICATION. Large skate with a broad granular rhombic disc (width 1.2 times length), very long pointed snout with firm rostral cartilage, small eyes, 1–3 nuchal thorns, lumbar thornlets in adults, and greyish to brown skin with small black pectoral ocelli. Disc anterior margin strongly concave in adults, less so in young; pectoral apices narrowly rounded to angular. Snout length 4–6 times orbit length, 19–20% TL; interorbital space up to 1.8 times orbit length in adults. Tooth rows in upper jaw 37–49. Upper surface of young with denticles confined to interorbit and tail; adults also with larger thornlets beside eye and in median lumbar band; anterior half of ventral disc rough in adults. Thorns on disc confined to orbit, and nuchal and alar regions of males, becoming reduced or lost with growth. Tail short, depressed and slender (length 65–81% of precloacal length), not bulging near its mid-length; lateral folds well developed near tail tip; low sharp thorns in multiple staggered rows in adults of both sexes, usually with large paired thorns before first dorsal fin and between dorsal fins. Pelvic fin strongly notched, long anterior lobes only slightly shorter than posterior lobe. Dorsal fins broadly rounded, well to slightly separated, procaudal length 1.1–1.4 in snout length; caudal fin reduced to a low fold.

COLOUR. Brownish to greyish above, pectoral ocelli dark; disc sometimes faintly spotted. Ventral surface usually darker greyish, mottled with spots and/or blotches; sensory pores dark-edged, most obvious on snout.

SIZE. Attains at least 137 cm TL, but questionably recorded at 204 cm TL. Males mature at ~62–74 cm TL, females 70–100 cm TL; young hatch at 12–17 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; Bering Sea to Gulf of California (Mexico). Demersal on continental shelf and upper slope, often in association with hard bottoms, at 10–1070 m depths. Adults feed mainly on bony fishes.

SIMILAR SPECIES. Snout much longer and more pointed than other hardnose skates of the region. The Aleutian Skate (20.8), which has a similarly shaped but more flexible snout typical of the softnose skates, has a more granular disc and lacks orbital thorns.

PACIFIC STARRY SKATE

19.14

Beringraja stellulata (Jordan & Gilbert, 1880)

LC

IDENTIFICATION. Medium-sized skate with a broadly oval to heart-shaped disc (width 1.2–1.3 times length), rather short and bluntly pointed snout with firm rostral cartilage, rough skin covered with star-shaped denticles, large orbital and nape thorns but no shoulder thorns, and weakly defined pectoral ocelli. Disc anterior margin undulate; pectoral apices broadly rounded to angular. Snout length 2.6–2.8 times orbit length; eyes large, interorbital space slightly larger than orbit length. Tooth rows in upper jaw ~32–37. Skin on upper surface, apart from disc margin and pelvic fins, covered with large, widely spaced granular denticles, less so in largest adults; ventral surface uniformly smooth in young, granular over snout in adults. Up to 7 median thorns on nape; median series disjunct on abdomen; malar patch well developed in adult males, alar patch short. Tail strongly depressed, slightly shorter than disc length, without median bulge; lateral folds narrow; median thorns large, in staggered or linear row, lateral rows in adult males, additional lateral row in females. Pelvic fin large, flattened anterior lobe much shorter than posterior lobe. Dorsal fins low, broadly rounded, well separated with several interdorsal thorns, procaudal length 1.2–1.3 times snout length; caudal fin short.

COLOUR. Brownish above with pattern of darker spots and blotches; each pectoral fin often with a large, poorly defined ocellus and a smaller white ocellus. Ventral surface pale with darker blotches; sensory pores not dark-edged.

SIZE. Attains ~76 cm TL. Males mature at ~67 cm TL, females ~68 cm TL; young hatch at 12–16 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; northern California (USA) to Baja California (Mexico). Demersal, common inshore on continental shelf to 100 m depth, also deeper on continental slope to 730 m depths. Feeds on small bony fishes, cephalopods and shrimps.

SIMILAR SPECIES. The Pacific Starry Skate has very spiny skin and a less angular disc than other hardnose skates of the region.

BRIGHTSPOT SKATE

19.15

Breviraja claramaculata McEachran & Matheson, 1985

DD

IDENTIFICATION. Small skate with a subcircular to heart-shaped disc (width 1.1–1.2 times length), very short snout with rather flexible rostral cartilage, large eyes (orbit length 4.4–5.3% TL), discontinuous rosette of 5–7 orbital thorns, triangle of 16–24 thorns on nape-shoulder region, broad tail (1.4–1.7 times precloacal length), brownish dorsal coloration with symmetrically arranged white spots surrounded by darker brown blotches, and largely pale centrally on ventral disc. Disc anterior margin undulated, its apex broadly rounded. Snout length 1.3–2.1 and interorbital space 0.5–0.8 times orbit length respectively; its tip barely projecting. Tooth rows in upper jaw 31–40. Upper disc sparsely covered with dermal denticles and pelvic-fin lobes naked; ventrally smooth. Thorn patches well developed. Tail firm, tapering gradually; lateral folds narrow and only on posterior fourth of tail; three rows of small tail thorns. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins confluent; postdorsal tail section very short. Predorsal vertebrae 88–101.

COLOUR. Upper surface of disc brownish with 4–8 symmetrically arranged white spots; tail with three diagonal brown blotches or saddles at bases of dorsal and caudal fins. Ventral surface white except for brownish margin of disc and tips of pelvic-fin lobes; obvious brown blotch on snout tip.

SIZE. Attains at least 29 cm TL (subadult male holotype); no larger specimens known. Size at hatching unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; South Carolina to Florida (USA). Demersal on upper continental slope at 295–895 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the Spinose Skate (19.19), with which it overlaps in distribution in the Western Atlantic, but the Brightspot Skate has a spotted coloration (upper disc with large white spots rather than being plain coloured) and lacks dark greyish blotches on the undersurface of the mid-disc.

LIGHTNOSE SKATE

19.16

Breviraja colesi Bigelow & Schroeder, 1948

DD

IDENTIFICATION. Small skate with a subcircular to heart-shaped disc (width 1–1.2 times length), short snout with rather flexible rostral cartilage, medium-sized eyes (orbit length 4.5–4.8% TL), cluster of rostral thorns, rosette of 10–11 orbital thorns, triangle of thorns on nape-shoulder region, broad tail (1.4–1.6 times precloacal length), pale brown dorsal surface with dark spots and eye-sized white ocelli; largely pale centrally on ventral disc. Disc anterior margin weakly undulated, its apex broadly rounded. Snout length 1.7–2.2 and interorbital space 0.5–0.7 times orbit length respectively; its tip weakly projecting. Tooth rows in upper jaw 42–50. Upper disc almost entirely set with dermal denticles, except close to its anterior and posterior edges; ventrally smooth. Thorn patches well developed. Tail firm, tapering gradually, very narrow posteriorly; narrow lateral folds along entire tail; 5–7 irregular rows of tail thorns. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about 1/3 as high as long, confluent or with very short interspace; caudal fin about 1/3 of first dorsal-fin base length.

COLOUR. Upper surface pale brown, usually covered with widely scattered dark brownish spots and blotches, and larger, symmetrically arranged eye-sized ocelli (whitish spots with darker brown edges); ocelli mainly on pectoral fins (rather than mid-body), and one on each posterior pelvic-fin lobe. Ventral surface uniformly white or yellowish.

SIZE. Attains ~40 cm TL. Males mature at ~32 cm TL. Smallest recorded specimen 8 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Florida (USA), Bahamas and Cuba. Demersal on upper continental and insular slope at 220–625 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the Brightspot Skate (19.15), but usually has a more complex dorsal colour pattern consisting of spots and ocelli-like markings (rather than 4–8 large white spots).

MOULD'S SKATE 19.17

Breviraja mouldi McEachran & Matheson, 1995

NE

IDENTIFICATION. Small skate with a pronounced heart-shaped disc (width 1.1–1.3 times length) with widest point much closer to tail than its anterior tip, short snout with rather flexible rostral cartilage, medium-sized eyes (orbit length 4–4.8% TL), no rostral thorns, rosette of 9–11 orbital thorns, triangle of thorns on nape-shoulder region, broad-based tail (1.5–1.8 times precloacal length), brownish dorsal surface with weak mottling of paler blotches; largely pale centrally on ventral disc. Disc anterior margin strongly undulated, its apex broadly rounded. Snout length 1.8–2.3 and interorbital space 0.6–0.8 times orbit length respectively; its tip with small triangular process. Tooth rows in upper jaw 38–44. Upper disc sparsely covered with fine denticles; ventral surface and pelvic-fin lobes smooth; no lumbar thorns between scapular patch and thorn rows extending onto tail. Tail firm, tapering gradually; narrow lateral folds along entire tail; usually 3 median rows of small thorns extending from widest part of disc to dorsal fins. Pelvic-fin anterior lobe more than half length of posterior lobe. Dorsal fins similar in shape, bases confluent; caudal-fin upper lobe about 1/3 of first dorsal-fin base length. Predorsal vertebrae ~99–102.

COLOUR. Upper surface uniform pale brown, or often with weak mottling of pale blotches; snout pale beside rostral cartilage; dorsal and caudal fins with brown blotches; ventral surface pale brown, with darker brownish blotch at snout tip.

SIZE. Attains ~41 cm TL. Males thought to mature at ~36 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Honduras to Panama. Demersal on upper continental slope at 355–775 m depths. Biology poorly known.

SIMILAR SPECIES. The similar Lightnose Skate (19.16) has a stronger mottled pattern on the upper disc, lacks a dark blotch on the undersurface of the snout, and has only 1 row of median thorns on the posterior disc (rather than 3). Once called *Breviraja schroederi*, but its name was changed to avoid confusion with a species of *Bathyraja*, the Whitemouth Skate (20.46), which also once had the same name.

BLACKBELLY SKATE

19.18

Breviraja nigriventralis McEachran & Matheson, 1985

DD

IDENTIFICATION. Small skate with a subcircular to heart-shaped disc (width 1.1–1.2 times length), short snout with rather flexible rostral cartilage, medium-sized eyes (orbit length 4.2–4.7% TL), rosette of 6–9 orbital thorns, triangle of 11–23 thorns on nape-shoulder region, broad tail (1.5–1.6 times precloacal length), and uniform brownish grey dorsal and black ventral coloration. Disc anterior margin weakly undulated, its apex broadly rounded. Snout length 1.6–1.9 and interorbital space 0.7–0.8 times orbit length respectively; its tip weakly projecting. Jaws strongly arched on either side of symphysis; lower jaw with spatula-like process that partially overlaps symphysis of upper jaw; tooth rows in upper jaw 37–44. Upper disc almost entirely set with fine dermal denticles with only anterior pelvic lobe naked; ventrally smooth. Thorn patches well developed. Tail firm, tapering gradually; lateral folds very narrow and only on posterior fourth of tail; five rows of tail thorns, beginning on posterior half of disc. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins confluent; upper caudal-fin lobe greater than half height of second dorsal fin; lower caudal-fin lobe present. Predorsal vertebrae 100–108.

COLOUR. Upper surface dark greyish brown to blackish, with black dorsal and caudal fins. Ventral surface almost uniformly black, except for paler greyish areas on rostrum and belly, near pectoral-fin axils, and along posterior disc margin.

SIZE. Attains ~44 cm TL. Males mature at ~38–40 cm TL. Size at hatching unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; Panama to French Guiana. Demersal on upper continental slope at 550–775 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the Spinose Skate (19.19), but the Blackbelly Skate has more strongly arched jaws, and a taller upper caudal-fin lobe and lower caudal-fin lobe (otherwise absent).

SPINOSE SKATE

19.19

Breviraja spinosa Bigelow & Schroeder, 1950

DD

IDENTIFICATION. Small skate with a subcircular to heart-shaped disc (width 1.2–1.4 times length), short snout with rather flexible rostral cartilage, rather large eyes (orbit length 4.3–4.9% TL), rosette of 6–10 orbital thorns, triangle of 14–18 thorns on nape-shoulder region, 3 rows of small thorns along mid-line of posterior half of disc, broad tail (1.4–1.6 times precloacal length), and uniformly brownish dorsal coloration. Disc anterior margin weakly undulated, its apex broadly rounded. Snout length 1.4–2 and interorbital space 0.7–0.8 times orbit length respectively; its tip weakly projecting. Lower jaw without spatula-like process overlapping symphysis of upper jaw; tooth rows in upper jaw 40–44. Upper disc almost entirely set with dermal denticles with naked patches over body cavity, and posterior margins of disc and pelvic-fin lobes; ventrally smooth. Thorn patches well developed. Tail firm, tapering gradually; lateral folds narrow and only on posterior third of tail; 5 rows of tail thorns, beginning on posterior half of disc. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins about 1/4 as high as long and confluent; caudal-fin upper lobe about 1/3 of first dorsal-fin base length, lower caudal-fin lobe absent. Predorsal vertebrae 95–101.

COLOUR. Upper surface brownish; ventral surface similar with sooty grey blotches at least on central disc, anterior pelvic-fin lobes, and anterior fourth of tail.

SIZE. Attains ~33 cm TL. Males mature at ~25 cm TL, females at ~29 cm TL. Size at hatching unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; South Carolina to Florida (USA). Demersal on upper continental slope at 365–670 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the Blackbelly Skate (19.18), but the jaws of the Spinose Skate are less strongly arched, the lower jaw lacks a spatula-like process (otherwise present), the ventral surface has both dark and pale patches (*vs.* almost uniformly dark), and lower lobe of the caudal fin is missing (otherwise present).

SKILLET SKATE

19.20

Dactylobatus armatus Bean & Weed, 1909

DD

IDENTIFICATION. Small skate with a rough subcircular disc, long and narrow lobe projecting from margin of each pectoral fin, very obtuse snout with firm rostral cartilage, small eyes, short tail, pelvic fins weakly bilobed, and blotchy markings on upper surface. Disc anterior margin uniformly convex forward of pectoral lobes, almost 1.4 times broader than long including pectoral lobes. Snout moderately long, length ~3 times orbit length, with small triangular tip; interorbital space about equal to orbit length. Tooth rows in upper jaw 54–66. Disc surface sparsely covered with partly embedded conical denticles; largely smooth below but anterior edge of disc with double row of hooked thornlets. Small thorns around orbital rim and spiracle, on nuchal and scapular regions, and in median row along disc and tail; median thorns on posterior disc and tail flanked by rows of smaller thorns. Tail slender (equal to or slightly longer than precloacal length), with narrow lateral folds. Pelvic-fin lobes separated by an evenly concave margin. Dorsal fins low and rounded, bases connected or separated slightly; procaudal length slightly longer than snout length; caudal fin short, very low.

COLOUR. Greyish brown with a dense pattern of blackish spots and blotches above; blotches circular to oval and varying in size (usually larger than diameter of eye); outer margins of dorsal fin dusky. Ventral surface whitish with extensive brownish or dusky areas on disc.

SIZE. Attains at least 32 cm TL, no adult males have been observed.

HABITAT AND BIOLOGY. Western Central Atlantic; South Carolina (USA) to Venezuela, patchy and uncommon. Demersal on continental slope at 340–685 m depths. Life history unknown.

SIMILAR SPECIES. No other skate has a prominent lobe extending from the apex of each side of an unusually shaped disc (the anterior and posterior disc margins are also extremely convex). Its distributional range overlaps with the larger Hook Skate (19.21).

HOOK SKATE

19.21

Dactylobatus clarkii (Bigelow & Schroeder, 1958)

DD

IDENTIFICATION. Medium-sized skate with a large, heart-shaped spiny disc, very obtuse snout with firm rostral cartilage, small eyes, short tail, pelvic fins distinctly bilobed, and upper surface brownish, usually with some small white markings. Disc ~1.2 times broader than long; anterior margin strongly convex with short concavity either side of snout tip, appearing trilobed. Snout long, length ~4.5 times orbit length; interorbital space ~1.4 times orbit length. Tooth rows in upper jaw 60–63. Disc surface sparsely covered with small denticles; thornlets present along anterior margin of disc; largely smooth below but anterior edge of disc with double row of hooked thornlets. Small to moderate-sized thorns present around orbit, spiracle, mid-line of snout, and forming a triangular patch over shoulder; median row extending along disc and onto tail; median thorns on tail densely flanked by similar broad-based thorns with thin sharp tips. Tail slender (shorter than precloacal length), with narrow lateral folds. Pelvic fin large, anterior lobe ~2/3 length of posterior lobe. Dorsal fins low, bases varying from almost connected to well separated; procaudal length subequal to snout length; caudal fin rudimentary.

COLOUR. Pale brown above, usually with small, symmetrically arranged, sharp-edged white spots or ocelli; pale markings best developed at level of spiracle and thorns paler than body. Ventral surface white, with dark margins around posterior edges of disc and pelvic fins.

SIZE. Attains at least 75 cm TL.

HABITAT AND BIOLOGY. Western Atlantic; South Carolina (USA) to Rio Grande (Brazil), distribution patchy. Demersal on muddy bottoms of continental and insular slopes at 300–915 m depths. Feeds on small bony fishes. Knowledge of its life history limited.

SIMILAR SPECIES. Differs from the other member of the genus *Dactylobatus*, the Skillet Skate (19.20), in lacking prominent laterally directed lobes at the apices of the pectoral fins.

SYDNEY SKATE

19.22

Dentiraja australis (Macleay, 1884)

VU

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width less than 1.2 times length), short and narrowly pointed snout with firm rostral cartilage, single nuchal thorn, 2 malar patches beside eye in mature males, rosette of thorns around orbital rim in adults (usually 4 in juveniles), tail short, broad and very depressed tail (~0.7–0.8 times precloacal length), and upper surface brownish with paler yellowish blotches. Disc anterior margin double concave in adult males, straight to slightly concave in females and juveniles; pectoral apices broadly rounded. Snout length 3.4–4.5 times orbit length; interorbital space 1–1.2 times orbit length. Tooth rows in lower jaw 38–43. Disc smooth, granulations at snout tip and along head margin on both surfaces of adults, more widespread forward of mouth in adult males. Tail with well-developed lateral folds, no median bulge; large thorns in 3 rows in males, 5 rows in adult females. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, close together or connected; located near tail tip; caudal fin short, very low. Pectoral-fin radials 78–81. Predorsal vertebrae 70–74.

COLOUR. Dark yellowish brown with paler yellowish blotches and streaks; disc paler around margin and on snout; tail and dorsal fins brownish. Ventral surface whitish with darker greyish patches near disc centre; sensory pores usually dark-edged, usually encircled by greyish areas.

SIZE. Attains ~55 cm TL. Males mature at 43–48 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off eastern Australia. Demersal on inner continental shelf to upper slope at 20–325 m depths. Biology little known; appears to have suffered population declines in recent years.

SIMILAR SPECIES. Resembles the Australian Longnose (19.24) and Whitespotted (19.23) Skates from southern Australia, but has a broader tail with more rows of tail thorns, and 2 malar thorn patches (rather than 1) on each side.

WHITESPOTTED SKATE

19.23

Dentiraja cerva (Whitley, 1939)

NT

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width less than 1.2 times length), short and narrowly pointed snout with firm rostral cartilage, 1–3 nuchal thorns, single malar patch, rosette of thorns around orbital rim in adults (3 in juveniles), no denticles on anteroventral margin of disc, tail short and broad (~0.8–0.9 times precloacal length), and upper surface distinctly white-spotted. Disc anterior margin double concave in adult males, otherwise straight to slightly concave; pectoral apices broadly rounded. Snout length 3.4–4.4 times orbit length; interorbital space 1.2–1.5 times orbit length. Tooth rows in lower jaw 35–37. Disc smooth in juveniles, granulations at snout tip dorsally in females and extending along head margin in adult males; smooth ventrally, with denticles confined to snout tip in adult males. Tail with well-developed lateral folds, no median bulge; thorns usually in double median row in males, additional lateral rows in adult females. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, close together or connected; located near tail tip; caudal fin short, very low. Pectoral-fin radials 82–85. Predorsal vertebrae 72–79.

COLOUR. Disc yellowish to greyish brown, covered with numerous, small white spots of similar size; sometimes also with larger faint dusky blotches; tail of juveniles darker banded below dorsal fins. Ventral surface whitish, often with darker greyish patches; sensory pores usually dark-edged, sometimes encircled by greyish areas.

SIZE. Attains ~66 cm TL. Males mature at ~45 cm TL; young hatch at ~11 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; off southern Australia. Demersal, continental shelf and upper slope at 60–470 m depths. Reaches maturity after 5 years; feeds on benthic crustaceans, small fishes and octopi.

SIMILAR SPECIES. Most similar to the co-occurring Australian Longnose Skate (19.24), but is more distinctly white-spotted (rather than spotted and reticulated) with a smooth anterior ventral disc margin lacking denticles.

AUSTRALIAN LONGNOSE SKATE

19.24

Dentiraja confusa (Last, 2008)

CR

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width 1.1–1.2 times length), short and narrowly pointed snout with firm rostral cartilage, 0–6 nuchal thorns, single malar patch, rosette of thorns around orbital rim in adults (usually 4 in juveniles), anteroventral margin of disc granular, tail short and rather broad (~0.7–0.8 times precloacal length), and complex colour pattern on upper surface. Disc anterior margin double concave in adult males, otherwise straight to slightly concave; pectoral apices broadly rounded. Snout length 3.3–5 times orbit length; interorbital space 1–1.5 times orbit length. Tooth rows in lower jaw 33–40. Dorsal disc usually smooth in juveniles and adult males, head granular in females; ventrally, denticles extending along anterior disc margin and on mid-snout in adults. Tail with well-developed lateral folds, no median bulge; thorns usually in double median row in males, additional lateral rows in adult females. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, close together or connected; located at tail tip; caudal fin short, very low. Pectoral-fin radials 78–83. Predorsal vertebrae 69–75.

COLOUR. Disc yellowish to brown (rarely greyish), covered with a complex pattern of paler spots, blotches and reticulations of varying sizes. Ventral surface whitish, often with darker greyish patches centrally; sensory pores usually dark-edged, sometimes encircled by greyish areas.

SIZE. Attains ~70 cm TL. Males mature at 47–53 cm TL; young hatch at ~10 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; off south-eastern Australia. Demersal, mainly continental shelf at 20–120 m depths, but rarely deeper to 390 m. Reproduces throughout the year and reaches maturity at 5–6 years; feeds mainly on benthic crustaceans, particularly crabs and shrimps.

SIMILAR SPECIES. Confused with the sympatric Whitespotted Skate (19.23), the Australian Longnose Skate occurs mainly at shallower depths, and has a more complex dorsal colour pattern and a band of denticles along the anterior ventral disc margin (except in early juveniles).

ENDEAVOUR SKATE

19.25

Dentiraja endeavouri (Last, 2008)

NT

IDENTIFICATION. Small skate with a weak rhombic disc (width 1.1–1.2 times length), short and narrowly pointed snout with firm rostral cartilage, 1–2 nuchal thorns, single malar patch, mid-orbital thorns usually absent (3 thorns in juveniles), anteroventral margin of disc only granular in females, rather broad and depressed tail (slightly shorter than precloacal length), and complex dorsal colour pattern. Disc anterior margin double concave in adult males, otherwise straight to slightly concave; pectoral apices broadly rounded. Snout length 3.2–4.4 times orbit length; interorbital space 0.8–1.1 times orbit length. Tooth rows in lower jaw 33–41. Dorsal disc usually smooth in juveniles and adult females, weak denticles at snout tip and along anterior margin of disc in males. Tail with well-developed lateral folds, no median bulge; thorns usually in paired median and sometimes weaker dorsolateral rows in males, additional lateral row on each side in adult females. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe. Dorsal fins tilted posteriorly, widely separated, located well forward of tail tip; caudal fin low. Pectoral-fin radials 76–81. Predorsal vertebrae 69–77.

COLOUR. Disc mainly dark brown with widely spaced clusters of small blackish spots and pale cloudy markings; clusters forming 4 bands on tail; dorsal fins brown with darker bases. Ventral surface usually white, sometimes with greyish patches near mouth and centrally on disc; sensory pores usually dark-edged, often encircled by greyish areas.

SIZE. Attains at least 37 cm TL. Males mature at ~30 cm TL, females ~31 cm TL; young hatch at 10–11 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off eastern Australia. Demersal, outer continental shelf and upper slope at 110–370 m depths. Diet mainly based on crustaceans; amphipods and carid shrimps (juveniles), and prawns and bony fishes (adults).

SIMILAR SPECIES. Temperate relative of the tropical allopatric Argus Skate (19.31) from Queensland, but differs from that ray mainly in having a broader tail and richer colour pattern (i.e. fewer and denser clusters of dark spots and pale blotches).

FALSE ARGUS SKATE

19.26

Dentiraja falloarga (Last, 2008)

DD

IDENTIFICATION. Small skate with a weakly rhombic disc (width less than 1.2 times length), short and broadly pointed snout, firm rostral cartilage, small nuchal thorn, 3–5 small orbital thorns, malar patch beside eye, granular denticles along anteroventral margin of disc of adults, slender tail (0.9–1 times precloacal length), and pale upper surface with white markings on central and posterior disc. Disc anterior margin weakly double concave; pectoral apices narrowly rounded. Snout length 4.3–4.9 times orbit length; interorbital space 1–1.4 times orbit length. Tooth rows in lower jaw 34–41. Dorsal disc largely smooth, except for denticles at snout tip and along anterior margin of disc; denticles cover most of preoral head on ventral surface, extending on to belly in largest adults. Tail weakly depressed, lacking a median bulge, and well-developed posterior lateral folds; thorns in median row with short dorsolateral thorns in males, similar in females but with better-developed dorsolateral rows and short lateral rows. Pelvic fin rather small, anterior lobe shorter than posterior lobe. Dorsal fins small, tilted, widely separated; well separated from tail tip; caudal fin minute. Pectoral-fin radials 76–81. Predorsal vertebrae 71–80.

COLOUR. Pale yellowish grey to brownish with an irregular pattern of white spots, streaks and blotches, often forming a weak ocellus on each pectoral fin. Ventral surface pale, greyish on central disc and around mouth; sensory pores dark-edged, often encircled by greyish areas.

SIZE. Attains at least 49 cm TL. Males mature at ~40 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off north-western Australia. Demersal on the outer continental shelf and upper slope at 60–255 m depths. Biology little known.

SIMILAR SPECIES. Occurs off north-western Australia with the similar Arafura Skate (19.94). The False Argus Skate can be distinguished from that species by meristics, colour pattern, and has a shorter tail with the second dorsal fin much closer to the tail tip.

PYGMY THORNBACK SKATE 19.27

Dentiraja flindersi Last & Gledhill, 2008

DD

IDENTIFICATION. Small skate with a circular to heart-shaped disc, short and broadly pointed snout with firm rostral cartilage, very wide interorbital space, small orbital and nuchal thorns (when present), small malar thorn patch beside eye in adult males, dark marking on tip of ventral snout, upper surface brownish with white spots, and tail very short, broad and extremely depressed (0.8–0.9 times precloacal length). Disc anterior margin undulate in adult males, straight to slightly convex in females and juveniles; width 1.1–1.2 times length; pectoral apices broadly rounded. Snout length 3–4.1 times orbit length; interorbital width 1.3–1.9 times orbit length, 2.2–2.6 in snout length. Tooth rows in lower jaw 32–38. Disc upper surface smooth in juveniles; anterior margin and snout tip with granular denticles in adult males, denticles more widespread in females; 0–4 nuchal thorns; ventral surface of disc and tail entirely smooth. Tail with very well-developed lateral folds, no median bulge; small thorns typically in 3 rows in males, usually 5 rows in adult females, median row rarely commencing forward of cloaca. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, barely separated; located near tail tip; caudal fin minute. Pectoral-fin radials 70–74. Predorsal vertebrae 62–67.

COLOUR. Pale yellowish brown above, often covered with dense pattern of small white spots (lacking reticulations and broad peppering of black spots). Ventral surface uniformly white, apart from large greyish or black blotch at snout tip; sensory pores not dark-edged or encircled by greyish blotch.

SIZE. Attains ~33 cm TL. Males mature at ~29 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; restricted distribution off southern Australia. Demersal, inner continental shelf at 20–55 m depths. Biology little known.

SIMILAR SPECIES. Closely resembles the larger Australian Thornback Skate (19.29) from south-eastern Australia, but has a broader interorbital space (width less than 2.6 *vs.* more than 2.7 in snout length), and nuchal thorns do not normally form a continuous row with those of the hind disc.

HEALD'S SKATE

19.28

Dentiraja healdi (Last, White & Pogonoski, 2008)

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc (width less than 1.2 times length), elongate and broadly pointed snout with firm rostral cartilage, nuchal thorn rarely present; malar patch well developed and a rosette of thorns around orbital rim in adults; tail almost oval, slender (~0.8–0.9 times precloacal length in adults); disc uniform brown above. Disc anterior margin deeply concave and its apex angular. Snout length 5.1–8 times orbit length; interorbital space 1.2–1.9 times orbit length. Tooth rows in lower jaw 35–41. Dorsal disc smooth in young and females, granulations along head margin in adult adults; smooth ventrally apart from granulations along anterior disc margin and at snout tip. Tail of moderate length, no obvious median bulge, poorly developed lateral folds; thorns in single row in males and juveniles, mainly 5 rows in adult females. Pelvic fin short, anterior lobe shorter than posterior lobe. Dorsal fins rounded, raked, close together; slightly forward of tail tip. Pectoral-fin radials 74–79. Predorsal vertebrae 76–84.

COLOUR. Adults uniformly pale yellowish brown, darkest near eyes, at mid-disc and along tail, paler around disc margin; ventral surface greyish centrally, paler on outer disc and tail, white gill membranes strongly contrasted with head; sensory pores small, dark-edged, sometimes encircled by small dusky blotch; dorsal fins dusky in adults, black in juveniles.

SIZE. Attains at least 72 cm TL. Males mature at ~50 cm TL; young hatch at ~14 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off north-western Australia. Demersal, upper continental slope at 305–520 m depths. Biology unknown.

SIMILAR SPECIES. Allopatric with several other Australian long-snouted skates. Most similar to a member of the genus *Dipturus*, the larger Australian Deepwater Skate (19.32), but usually lacks a nuchal thorn (otherwise present), and has a paler posterior pectoral-fin margin and a shorter, less angular snout.

AUSTRALIAN THORNBACK SKATE

19.29

Dentiraja lemprieri (Richardson, 1845)

LC

IDENTIFICATION. Medium-sized skate with a subcircular to weakly rhombic disc, short and broadly pointed snout with firm rostral cartilage, wide interorbital space, continuous row of median thorns on disc, well-developed malar patch beside eye, dark marking on tip of ventral snout, upper surface coloration variable and usually with fine reticulations and dark blotches, and very short, broad and extremely depressed tail (0.7–0.9 times precloacal length). Disc anterior margin weakly double concave in adult males, straight to slightly convex in females and juveniles; width 1.1–1.2 times length; pectoral apices broadly rounded. Snout length 3.1–3.8 times orbit length; interorbital width 1.3–1.7 times orbit length, 2.7–3.2 in snout length. Tooth rows in lower jaw 31–37. Disc upper surface covered with fine granulations (very dense in adults); orbital thorns 6–10; nuchal thorns extending continuously along mid-disc and onto tail, base of tail often with 2–6 additional mid-lateral rows that extend along tail; ventral surface of disc smooth. Tail with well-developed lateral folds. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, barely separated or connected; located near tail tip; caudal fin minute. Pectoral-fin radials 78–81. Predorsal vertebrae 69–75.

COLOUR. Variably greyish black or brownish above, usually marbled with dense pattern of finer pale reticulations and darker spots and blotches; often with a small, widely spaced white pectoral marking. Ventral surface uniformly white, apart from prominent greyish or black marking at snout tip; sensory pores not dark-edged.

SIZE. Attains at least 55 cm TL. Males mature at ~39 cm TL, females ~42 cm TL; hatching size ~10 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; off south-eastern Australia. Demersal, continental shelf at 1–170 m depths, usually inshore on muddy bottoms shallower than 40 m. Diet consists of benthic crustaceans, octopods and small fishes.

SIMILAR SPECIES. Resembles the Pygmy Thornback Skate (19.27) from central southern Australia, but has a narrower interorbital space (width more than 2.7 *vs.* less than 2.6 in snout length), and a more spiny dorsal disc.

AUSTRALIAN OCELLATE SKATE

19.30

Dentiraja oculata (Last, 2008)

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.2 times length), moderately elongate and narrowly pointed snout with firm rostral cartilage, small nuchal thorn, malar patch present, 4–7 orbital thorns, anteroventral margin of disc, and snout tip and mid-line granular, ocellated colour pattern, and short, broad, depressed tail (0.7–0.9 times precloacal length). Disc anterior margin double concave in large males, otherwise straight to weakly concave; pectoral apices broadly rounded. Snout length 4.2–5.2 times orbit length; interorbital space 1.4–1.5 times orbit length. Tooth rows in lower jaw 34–40. Dorsal disc largely smooth, denticles confined to snout tip and anterior margin of disc. Tail with well-developed lateral folds, no median bulge; thorns in paired median rows in males, additional lateral row and shorter dorsolateral rows on each side in adult females. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, separated slightly, located forward of tail tip; caudal fin short. Pectoral-fin radials 80–89. Predorsal vertebrae 69–78.

COLOUR. Greenish grey with a paler margin and covered with dusky blotches; dark brown ocellus centrally on each pectoral fin; irregular pale spots with dark margins on posterior disc; tail with ~6 greenish saddles. Ventral surface pale greyish pink; sensory pores usually dark-edged, but not encircled by greyish areas.

SIZE. Attains at least 56 cm TL. Largest male an adolescent specimen, 46 cm TL (probably matures at ~50 cm TL).

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia. Demersal, upper continental slope at 200–390 m depths. Poorly known, no adult males in collections.

SIMILAR SPECIES. Only skate living in Australian seas with prominent ring-like pectoral markings. In the Indian Ring Skate (19.107), which also has a prominent ocellated pectoral marking, the central and outer parts of the ocellus are whitish rather than dark and the dorsal fins more widely separated.

ARGUS SKATE

19.31

Dentiraja polyommata (Ogilby, 1910)

LC

IDENTIFICATION. Small skate with a weak rhombic disc (width less than 1.2 times length), short and narrowly pointed snout with firm rostral cartilage, small nuchal thorn, single malar patch, mid-orbital thorns usually absent (3 thorns in juveniles), anteroventral margin of disc granular in females only, densely spotted pattern, and slender tail (slightly shorter than precloacal length). Disc anterior margin double concave in adult males, otherwise straight to slightly concave; pectoral apices narrowly rounded. Snout length 3.3–4.8 times orbit length; interorbital space 0.9–1.2 times orbit length. Tooth rows in lower jaw 38–43. Dorsal disc usually smooth in juveniles and adult females, bristle-like denticles at snout tip and denticles along anterior margin of disc in males. Tail with well-developed lateral folds, no median bulge; thorns usually in median and dorsolateral rows in males, usually additional lateral row on each side in adult females. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe. Dorsal fins tilted posteriorly, widely separated, located well forward of tail tip; caudal fin low. Pectoral-fin radials 77–79. Predorsal vertebrae 70–77.

COLOUR. Disc pinkish to greyish brown with irregular clusters of small, dark, white-edged spots; clusters forming 5–6 bands on tail; dorsal fins uniformly pale brown. Ventral surface pale, sometimes with greyish patches near mouth and centrally on disc; sensory pores usually dark-edged, often encircled by greyish areas.

SIZE. Attains ~38 cm TL. Males mature at ~30 cm TL, females at ~32 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off Queensland, eastern Australia. Demersal, continental shelf and upper slope at 135–400 m depths. Biology little known; feeds mainly on crustaceans (shrimps and prawns).

SIMILAR SPECIES. Closely related to the allopatric Endeavour Skate (19.25), but differs in having a more slender tail and plainer colour pattern (i.e. having diffuse clusters of white-edged dark spots).

AUSTRALIAN DEEPWATER SKATE

19.32

Dipturus acrobelus Last, White & Pogonoski, 2008

LC

IDENTIFICATION. Large skate with a broadly rhombic disc (width less than 1.2 times length), extremely elongate and narrowly pointed snout with firm rostral cartilage, 1–3 nuchal thorns, well-developed malar thorn patch, rosette of thorns around orbital rim in adults, tail almost oval in cross-section and slender (~0.7–0.8 times precloacal length in adults), and disc paler above than below. Disc strongly depressed, thin, anterior margin very deeply concave and its apex angular. Snout length 5.2–9.7 times orbit length; interorbital space 1–1.9 times orbit length. Tooth rows in lower jaw 31–41. Dorsal disc mostly smooth, some denticles around eyes; smooth ventrally, apart from denticles along anterior disc margin and at snout tip. Tail short with weak median bulge, narrow lateral folds; tail thorns in 1–3 rows in males, 1–6 rows in females. Pelvic fin short, anterior lobe about equal to posterior lobe in young. Dorsal fins rounded, upright, close together; near tail tip. Pectoral-fin radials 83–88. Predorsal vertebrae 78–85.

COLOUR. Adults uniformly pale grey to brownish above. Ventral surface darker, brownish or black; pectoral and pelvic-fin margins, and snout tip black; sensory pores small, not obvious nor encircled by dark margin. Dorsal fins greyish in adults, black in juveniles.

SIZE. Attains at least 137 cm TL. Males mature at 89–95 cm TL; young hatch at ~20 cm TL.

HABITAT AND BIOLOGY. South-West Pacific and South-East Indian Ocean; off southern Australia. Demersal on upper and mid-continental slope at 445–1330 m depths, most commonly at 800–1000 m. Biology not well known.

SIMILAR SPECIES. General appearance similar to the sympatric Bight Skate (19.46), but the Australian Deepwater Skate occurs on the deeper continental slope. Unlike the Australian Bight Skate, adults are typically paler on the upper disc surface than ventrally, always possess nuchal thorns, and adult males have a well-developed malar thorn patch beside each eye.

RIDGEBACK SKATE

19.33

Dipturus amphispinus Last & Alava, 2013

NE

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width ~1.2 times its length), moderately elongate and narrowly pointed snout with firm rostral cartilage, 0–5 nuchal thorns, 1–2 strong scapular thorns, no malar thorns, ridge of large median lumbar thorns (in 2 parallel rows) on posterior disc, rosette of 9–17 orbital thorns, 3 well-developed rows of tail thorns in females, denticles on anterior margins of both surfaces of disc, uniformly brownish dorsally, and short, slender tail (0.7–0.9 times precloacal length). Disc anterior margin double concave; pectoral apices narrowly rounded to angular. Snout length 4.7–7.4 times orbit length; interorbital space 1.3–1.8 times orbit length. Tooth rows in lower jaw ~33. Disc largely smooth, in adults dorsal denticles present at snout tip and along anterior margin; ventral denticles over much of head, also over belly. Lumbar thorns with thick bases and sharp tips; thorn rows directed laterally away from each other. Tail firm, oval in cross-section, with poorly developed lateral folds, no obvious median bulge; thorns usually in single median row in males (occasionally with a few laterals near tail base), additional lateral row on each side of adult females. Pelvic fin medium-sized, anterior lobe shorter than posterior lobe. Dorsal fins tilted, separated slightly; well separated from tail tip; caudal fin low, long based. Pectoral-fin radials 83–85. Predorsal vertebrae 77–83.

COLOUR. Uniformly medium brown, paler beside mid-snout; thorns yellowish or white. Ventral surface slightly paler and more blotched than dorsal surface; sensory pores dark-edged, not encircled by greyish blotch.

SIZE. Attains at least 90 cm TL. Males mature at ~62–66 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Philippine Archipelago. Demersal, capture depth unknown but probably deep insular slopes of region. Biology unknown.

SIMILAR SPECIES. Most similar to the China Skate (19.69) but differs in meristics, having more prominent lumbar thorns, and more thorn rows on the tail of large females (3 rows rather than 1).

PALE TROPICAL SKATE

19.34

Dipturus apricus Last, White & Pogonoski, 2008

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc (width exceeding 1.2 times length), very elongate and pointed snout with firm rostral cartilage, no nuchal or malar thorns, no rosette of thorns around orbital rim, tail oval to almost circular in cross-section and slender (0.7–0.9 times precloacal length in adults), and uniform greyish brown above and dusky below. Disc anterior margin deeply concave and its apex angular. Snout length 6.2–7.9 times orbit length; interorbital space 1.4–1.9 times orbit length. Tooth rows in lower jaw 30–37. Dorsal disc smooth in young and females, with denticles on head of adult males; no thorns on mid-disc before tail; ventrally with denticles along anterior disc margin and snout, elsewhere smooth. Tail short, with weak median bulge, lateral folds poorly developed; thorns mainly in single row, females with additional 1–2 pairs of short lateral rows near tail base. Pelvic fin small, anterior lobe exceeding posterior lobe in young. Dorsal fins rounded, raked, separated slightly; positioned slightly forward of tail tip. Pectoral-fin radials 86–91. Predorsal vertebrae 75–83.

COLOUR. Adults uniform greyish brown dorsally, paler on snout and around pectoral-fin hind margins; ventral surface variable, greyish brown and blotchy, sensory pores well defined, black-edged but not encircled by dusky blotches; dorsal-fin bases brownish, upper caudal-fin lobe pale.

SIZE. Attains at least 77 cm TL. Males mature at 55–66 cm TL; young hatch at ~15–17 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off Queensland (Australia). Demersal on outer continental shelf and upper slope at 195–605 m depths, most common at 300–500 m. Life history unknown. Diet probably consists mainly of small bony fishes.

SIMILAR SPECIES. Similar to the larger Bight Skate (19.46) which occurs further south in Australian waters. The Pale Tropical Skate has a relatively narrower disc, fewer thorns around the eye, and a paler upper caudal-fin lobe.

COMMON BLUE SKATE

19.35

Dipturus batis (Linnaeus, 1758)

CR

IDENTIFICATION. Large skate with a broadly rhombic disc (wider than long), long and pointed snout with firm rostral cartilage, small malar thorns present, no nuchal thorns or thorns around orbital rim in adults, tail robust (0.8–0.9 times precloacal length), and disc similarly dark above and below. Disc anterior margin very deeply concave and its apex angular. Snout broadly angular, length 5–6.3 times orbit length; interorbital space 1.5–2.1 times orbit length. Disc smooth in young; denticles confined to dorsal head and along anterior disc margin on both surfaces in adults; disc thorns small in young, largely absent in adults. Tail moderate, lacking median bulge; 12–31 predorsal thorns in median row; adults with additional rows of outward-pointing lateral thorns. Pelvic fin short, anterior lobe much shorter than posterior lobe. Dorsal fins rounded, upright, near tail tip, separated by much less than half dorsal-fin base length.

COLOUR. Brownish with paler blotches and streaks, and prominent oval, ring-like pectoral markings (yellowish outer ring surrounding darker centre); iris yellowish. Undersurface greyish, adults mostly paler apart from greyish head and mid-disc; sensory pores appear as black spots and streaks.

SIZE. Attains ~143 cm TL. Males mature at ~115 cm TL, females 123 cm TL; young hatch at ~21 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; Iceland to British Isles. Once more widespread, including Mediterranean Sea and north-west Africa; range possibly reduced from overfishing. Demersal, near coast to continental slope at ~600 m depth, most common at ~100 m depth. Biology unclear due to past taxonomic confusion. Lays egg cases during spring and summer with long embryonic development. Feeds on benthic invertebrates and fishes, including other skates.

SIMILAR SPECIES. Confused with the larger sympatric Flapper Skate (19.48), but has a narrower interdorsal space (less than 1.8% rather than usually exceeding 2% TL), more distinctive pectoral marking, and the eye (iris) is yellowish (rather than greenish). Also referred to as *Dipturus* sp. cf. *flossada* (Risso, 1826).

TORTUGAS SKATE

19.36

Dipturus bullisi (Bigelow & Schroeder, 1962)

DD

IDENTIFICATION. Medium-sized skate with a very broad rhombic disc (width ~1.3 times length), smooth skin, long and rather broadly pointed snout with firm rostral cartilage, 2–3 small orbital thorns, 1 nuchal thorn, tail weakly depressed, slender (0.9–1 times precloacal length in adults), and disc darker below than above. Disc anterior margin undulate and most concave anteriorly, its apex narrowly rounded. Snout length ~4.6 times orbit length; interorbital space 1.1–1.3 times orbit length. Tooth rows in upper jaw 31–36. Skin on dorsal surface of disc entirely smooth; ventrally, usually with denticles on snout and along anterior margin of disc. Thorns in single median row, ~12–15 on mid-tail. Tail rather short, not markedly swollen slightly before dorsal fins; lateral fold long, narrow, commencing near pelvic fins. Pelvic fin well developed, anterior lobe only slightly shorter than posterior lobe. Dorsal fins low, tilted slightly, separated slightly; near tail tip; caudal fin well developed, equal to or longer than first dorsal-fin base length.

COLOUR. Dorsal surface uniform pale brown. Ventral surface darker brown; relatively inconspicuous dark sensory pores on snout and posterior to lower jaw.

SIZE. Attains at least 77 cm TL. Males at ~76 cm TL were sexually mature; young hatch at ~16 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Mexico to northern Brazil, including Caribbean islands. Demersal on outer continental shelf and upper slope at 185–550 m depths. Little known of its life history.

SIMILAR SPECIES. Within the region, most similar to the Caribbean Skate (19.65), but has a shorter tail (equal to or shorter than *vs.* usually longer than precloacal length) and a nuchal thorn (otherwise absent); most other species of *Dipturus* in this region lack a nuchal thorn.

BLACKSPOT SKATE

19.37

Dipturus campbelli (Wallace, 1967)

NT

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.2 times length), elongate and narrowly pointed snout with firm rostral cartilage, 1–2 nuchal thorns, narrow patch of small malar thorns in mature males, rosette of thorns around orbital rim, lumbar thorns, granular denticles along anteroventral margin of disc, swollen tail (slightly shorter than precloacal length), and disc black-spotted above and dark underneath. Disc anterior margin concave to weakly double concave; pectoral apices broadly rounded. Snout length ~3.6–3.7 times orbit length; interorbital space 0.8–0.9 times orbit length. Tooth rows in lower jaw 38–42. Disc largely smooth above, with granular denticles on snout tip, near eyes, and on upper tail and dorsal fins. Tail broad, swollen slightly at its mid-length (more so in large females), lateral folds well developed; alternating large and small thorns in median row extending from mid-abdomen onto tail; additional short row of lateral thorns near base of tail in females. Pelvic fin large, anterior lobe much shorter than posterior lobe; clasper of adult male very long, much longer than snout and almost reaching first dorsal fin. Dorsal fins broadly rounded, separated slightly, rather close to tail tip; caudal fin rudimentary.

COLOUR. Greyish to brownish with numerous black spots scattered irregularly over upper disc. Ventral surface greyish; sensory pores black, conspicuous, widespread over snout and in mouth and gill regions.

SIZE. Attains at least 66 cm TL. Males are mature at ~57 cm TL, females ~64 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; South Africa to Mozambique. Demersal on continental shelf and upper slope at 130–405 m depths. Biology little known.

SIMILAR SPECIES. Off southern Africa, has been confused with the larger Slime Skate (19.61), but the Blackspot Skate lacks a prominent pectoral marking, the anterior edge of disc is rough underneath (otherwise smooth), and its tail is thicker at its mid-length than at its base (rather than gradually tapering).

GREY SKATE

19.38

Dipturus canutus Last, 2008

EN

IDENTIFICATION. Medium-sized skate with a rhombic disc (width 1.2–1.3 times length), moderately elongate and narrowly pointed snout with firm rostral cartilage, 1–3 nuchal thorns, small malar thorn patch beside eye in mature males, rosette of thorns around orbital rim in adults, no denticles along anteroventral margin of disc, uniformly greyish disc, and short, thin tail (slightly shorter than precloacal length). Disc anterior margin straight to weakly double concave; pectoral apices narrowly rounded. Snout length 3.8–5.5 times orbit length; interorbital space 1–1.6 times orbit length. Tooth rows in lower jaw 33–40. Disc almost entirely smooth, denticles at snout tip when mature only; denticles also around malar region and at base of tail in adult males and females respectively. Tail oval in cross-section (not greatly depressed), with poorly developed lateral folds, no obvious median bulge; thorns in paired median row in males (occasionally with a few laterals near tail base), additional lateral row on each side of adult females. Pelvic fin large, anterior lobe much shorter than posterior lobe; adult male clasper long, about equal to snout length. Dorsal fins broadly rounded, usually separated slightly; close to tail tip; caudal fin low, long based. Pectoral-fin radials 81–88. Predorsal vertebrae 75–82.

COLOUR. Uniformly pale greyish, greyish blue or greyish brown. Ventral surface whitish, uniformly pale or with irregular dark greyish patches around pelvic fin and cloaca; sensory pores usually indistinct, sometimes weakly dark-edged.

SIZE. Attains ~90 cm TL. Males mature at ~64 cm TL; young hatch at ~13 cm TL.

HABITAT AND BIOLOGY. South-West Pacific and South-East Indian Ocean; off southern Australia. Demersal, mainly on upper continental slope at 330–730 m depths, but known from 155–1050 m. Biology little known.

SIMILAR SPECIES. Resembles Graham's Skate (19.45), but lacks denticles on the ventral margin of the head, and has malar thorns, a paler belly and smaller claspers.

POLKADOT SKATE

19.39

Dipturus chinensis (Basilewsky, 1855)

NE

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width 1.2–1.3 times length), narrowly pointed snout with firm rostral cartilage, 1–2 nuchal thorns usually present, narrow malar thorn patch beside eye in adult males, rosette of ~8 sharp thorns around orbital rim, narrow tail (0.8–1.1 times precloacal length), dark greyish brown above and densely covered with large yellowish cloudy blotches. Disc anterior margin weakly double concave in adult males, straight to slightly wavy in females and juveniles; pectoral apices narrowly rounded, more angular in adult males. Snout moderately elongate, length 3.1–4.4 times orbit length, interorbital space 1–1.1 times orbit length in adults. Tooth rows in lower jaw ~33–35. Disc largely smooth; denticle patches at snout tip on both surfaces and along anterior ventral edges of snout. Tail thorns sharp, closely spaced, arranged in staggered median row; pair lateral thorn rows present in females. Tail tapering with well-developed posterior lateral folds, no median bulge. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, close together; located near tail tip; caudal fin short, low. Pectoral-fin radials 80–89. Predorsal vertebrae 72–79.

COLOUR. Greyish brown on dorsal surface with strong pattern of yellowish regular blotches (mainly circular or oval, and often indistinct in adults); pectoral markings present, similar to blotched pattern. Ventral surface bluish white to pale grey (often covered with dark mucous areas); sensory pores indistinct.

SIZE. Attains at least 68 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; China to Japan, including Taiwan. Demersal and common on inner continental shelf at 20–80 m depths. Biology little known.

SIMILAR SPECIES. Confused with the Kwangtung Skate (19.50), which occurs further south in the Western Pacific. The Polkadot Skate has a shorter snout and more symmetrical pattern of blotches on the upper surface. Also closely resembles some members of the genus *Okamejei* in the North-West Pacific region.

MADAGASCAR SKATE

19.40

Dipturus crosnieri (Séret, 1989)

VU

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), elongate and narrowly pointed snout with firm rostral cartilage, 1–2 nuchal thorns, large malar thorn patch, rosette of thorns around orbital rim in adults, tail long and slender (length subequal to precloacal length), and upper disc plain greyish to brownish and darker ventrally in adults. Disc anterior margin undulate, double concave, its apex narrowly rounded. Snout length ~4.4–4.5 times orbit length; interorbital space 1–1.3 times orbit length. Tooth rows in lower jaw 29–36. Dorsal disc smooth in juveniles; denticles developing later on head, and median disc and tail; juveniles smooth ventrally, apart from fine denticles along anterior disc margin and snout tip (also over anterior disc and abdomen in adults). Orbital thorns 3 in juveniles; no scapular thorns. Tail with obvious bulge before dorsal fins; lateral folds developed only near dorsal fins; single median row of 14–31 thorns in males and juveniles, additional lateral row on each side in adult females. Pelvic fin medium-sized, anterior lobe subequal in length to posterior lobe. Dorsal fins broadly rounded, close together; barely forward of tail tip; caudal fin long, low. Pectoral-fin radials 84–91. Predorsal vertebrae 79–91.

COLOUR. Dorsal surface uniformly greyish or brownish, translucent beside rostrum; blackish on orbits and near tip of tail, including fins. Undersurface pale in young, much darker than dorsal surface in adults; posterior margins of disc and pelvic fins dark brown; sensory pores dark-edged.

SIZE. Attains at least 61 cm TL. Males mature at ~55 cm TL, females ~57 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; off Madagascar. Demersal on upper insular slope at 300–850 m depths. Biology unknown.

SIMILAR SPECIES. Like several other *Dipturus* skates in the Indian Ocean, it has relatively long anterior pelvic-fin lobes, particularly in females and young (almost equal to length of posterior lobes). The Roughbelly (19.63) and Travancore (19.49) Skates share this character and their relationships require further investigation.

JAVELIN SKATE

19.41

Dipturus doutrei (Cadenat, 1960)

DD

IDENTIFICATION. Large skate with a rhombic disc (width 1.1–1.2 times length at all sizes), elongate and pointed snout with firm rostral cartilage, nuchal thorn present or absent, weak rosette of thorns around orbital rim in adults, tail greatly thickened and short (~0.6 times precloacal length), upper disc plain brownish or weakly blotched, and ventral surface dark brownish with blotches. Disc anterior margin strongly double concave, more so in adults; apex narrowly rounded to abruptly acute. Snout length ~4–5 times orbit length; interorbital space 1.1–1.3 times orbit length. Tooth rows in upper jaw 27–35. Dorsal disc with poorly developed thorns and denticles; 6–7 orbital thorns in adult, often with single reduced nuchal thorn; granular denticles at snout tip extend along front edge of disc; ventral surface with fine denticles along anterior disc margin and along rostrum. Tail usually bulging beyond its base; lateral folds best developed near dorsal fins; 13–26 thorns in single median row in males and juveniles, additional lateral row of close-packed thorns on each side in adult females. Pelvic fin medium-sized, anterior lobe only slightly shorter than posterior lobe; claspers very long. Dorsal fins broadly rounded, close together; well forward of tail tip; caudal fin long based, low. Pectoral-fin radials 82–84. Predorsal vertebrae 68–80.

COLOUR. Dorsal surface dark brownish with scattered darker blotches; posterior margins of disc and pelvic fins blackish. Ventral surface dark brown, sometimes with paler blotches; sensory pores dark-edged.

SIZE. Attains ~115 cm TL. Males are mature at ~101 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic to South-West Indian Ocean; Senegal to South Africa (east to Cape Province). Demersal on outer continental shelf, and upper and mid-slope at 165–1200 m depths, usually at 450–600 m. Diet consists of benthic bony fishes, shrimps and crabs.

SIMILAR SPECIES. Differs from the Roughbelly Skate (19.63) from southern Africa in having a greatly thickened tail that is markedly broader at its mid-length than at its base.

ECUADOR SKATE

19.42

Dipturus ecuadoriensis (Beebe & Tee-Van, 1941)

DD

IDENTIFICATION. Small to medium-sized skate (no adults known) with a largely smooth rhombic disc (width ~1.3 times length), snout moderately elongate and narrowly pointed with firm rostral cartilage, 1 strong nuchal thorn, weak rosette of orbital thorns (dominated by 2 thorns on preorbit, 2 on postorbit), 8 rows of small thornlets near alar region of disc, and short depressed tail (~0.8 times precloacal length). Disc anterior margin weakly double concave; pectoral apices narrowly angular. Snout with prominent apical lobe; length ~5.5 times orbit length; interorbital space ~1.8 times orbit length. Tooth rows in upper jaw ~37. Dorsal disc largely smooth, denticles confined to apex of disc; anteroventral margin of disc with a band on tiny granular denticles. Tail with well-developed lateral folds, no obvious median bulge; ~17 robust thorns in median row before first dorsal fin, 2 interdorsally. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe. Dorsal fins large, raked, separated slightly, located well forward of tail tip; caudal fin long-based.

COLOUR. No information is available for coloration of this species. Presumably plain, because describing authors might have been more compelled to discuss an obvious pattern if it existed.

SIZE. Attains at least 39 cm TL; based on young male which given developed state of thorn patches on pectoral fins might be approaching maturity.

HABITAT AND BIOLOGY. Eastern Central Pacific; known from only two specimens collected in San Helena Bay, Ecuador. Demersal, depth distribution not known but presumably outer continental shelf and/or upper slope. More specimens and biological information are needed.

SIMILAR SPECIES. One of few *Dipturus* skates occurring in this region, and possibly the only one of these skates having well-developed rows of thornlets very close to the pectoral-fin apices in immature individuals. Alar thorn patches are usually only present in adult males of other skate species.

SAN BLAS SKATE

19.43

Dipturus garricki (Bigelow & Schroeder, 1958)

DD

IDENTIFICATION. Large skate with a broad rhombic disc (width ~1.3 times its length), moderately elongate and narrowly pointed snout with firm rostral cartilage, long median row of thorns extending along disc from nuchal region to dorsal fins, 1–2 shoulder thorns on each side, malar thorn patch well developed, rosette of orbital thorns, denticles extending along front margins of dorsal disc, brownish dorsally and dark bluish grey below, and short, strongly tapering tail (~0.7–0.8 times precloacal length). Disc anterior margin undulate to deeply concave (more so in adult males); pectoral apices narrowly angular. Snout length ~5.2 times orbit length, interorbital space ~1.6 times orbit length. Tooth rows in lower jaw ~35. Dorsal disc largely smooth, granular denticles confined to snout tip and along its anterior margins; disc largely naked ventrally, apart from denticles on snout and narrow bands along its anterior margins. Tail stiffened, tapering, no median bulge; lateral folds poorly developed; 25–33 variable-sized thorns in median row with shorter dorsolateral rows anteriorly. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe. Dorsal fins tilted, separated slightly, well removed from tail tip; caudal fin low.

COLOUR. Uniformly brownish on dorsal surface; sensory pores beside nuchal thorns very prominent. Ventral surface dark bluish grey or brownish; sensory pores on snout dark-edged, not encircled by greyish blotch.

SIZE. Attains at least 107 cm TL. Males mature at ~96 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; northern Gulf of Mexico to Nicaragua. Demersal on upper continental slope at 275–475 m depths. Biology unknown.

SIMILAR SPECIES. In the Western Central Atlantic, the Tortugas Skate (19.36) has only 1 thorn on the nape, whereas the San Blas Skate has a continuous row of thorns extending from the nuchal region to the tail.

GIANT SKATE

19.44

Dipturus gigas (Ishiyama, 1958)

DD

IDENTIFICATION. Very large skate with a broad rhombic disc (width ~1.3 times length), moderately elongate and pointed snout with firm rostral cartilage, single nuchal thorn in young (often missing in adults), rosette of small thorns around orbital rim, no enlarged malar thorn patch, pelvic-fin lobes subequal in length, tail swollen before dorsal fins (length 0.8–0.9 times precloacal length in adults), and both surfaces of disc very dark. Disc robust and thickened, anterior margin weakly double concave; apex narrowly rounded; posterior margin strongly convex. Snout length 5–6.7 times orbit length; interorbital space wide, 1.7–2 times orbit in adults. Dorsal disc surface densely granular in young, much smoother in adults with denticles confined to head and disc margins; ventrally, denticles on anterior disc margin and rostral tip (on ventral tail and belly in large females). Tail robust, rounded-oval in cross-section with broad median bulge; posterior lateral folds prominent in adults; thorns in a single row in males (often lost or small in adults), 3 rows of well-developed, scute-like thorns in adult females. Pelvic-fin anterior lobe very long, often longer than posterior lobe; clasper very large. Dorsal fins rounded, barely separated; positioned close to tail tip; caudal-fin upper lobe low. Predorsal vertebrae ~90–96.

COLOUR. Adults plain greyish brown above, not noticeably paler beside rostral cartilage; pelvic fins usually darker than most of disc; dorsal and caudal fins black. Ventral surface dark, similar to dorsal surface or slightly darker, often black; sensory pores barely visible even on snout.

SIZE. Attains ~186 cm TL. Male holotype mature at 135 cm TL, females at 115 cm TL; egg cases very large, to ~23 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Japan to Philippines. Demersal on sandy and muddy substrates of upper continental and insular slopes at ~300–1000 m depths. Diet consists of benthic invertebrates and bony fishes.

SIMILAR SPECIES. Similar to Weng's Skate (19.68), but has a relatively smaller snout/eye ratio in adults, rougher upper disc, and more vertebrae.

GRAHAM'S SKATE

19.45

Dipturus grahami Last, 2008

LC

IDENTIFICATION. Medium-sized skate with a very broad rhombic disc (width 1.3–1.4 times length), moderately elongate and pointed snout with firm rostral cartilage, single nuchal thorn, no malar thorn patch, prominent rosette of thorns around orbital rim, granular denticles along anteroventral margin of disc, uniformly greenish or greyish brown dorsal surface and dark ventral surface, and rather short, slender tail (0.8–0.9 times precloacal length). Disc anterior margin concave in females and juveniles, weakly double concave in adult males; pectoral apices angular. Snout length 4–4.9 times orbit length; interorbital space 1.2–1.7 times orbit length. Tooth rows in lower jaw 32–36. Dorsal disc mostly smooth, except for snout tip and denticle patch along anterior margin of disc in adult males; denticles cover most of preoral head on ventral surface. Tail oval in cross-section (not greatly depressed), with weak median bulge and poorly developed lateral folds; thorns in single median row in males, additional lateral row and shorter dorsolateral row on each side of adult females. Pelvic fin of moderate size, anterior lobe much shorter than posterior lobe; adult clasper very long, much longer than snout length. Dorsal fins elongate, separated slightly; first dorsal well forward of tail tip; caudal fin short. Pectoral-fin radials 80–85. Predorsal vertebrae 70–75.

COLOUR. Uniformly dark greenish brown or greyish brown, paler beside rostral cartilage; dorsal fins dark based. Ventral surface washed with black but paler than dorsal surface; sensory pores dark-edged, not encircled by greyish blotch.

SIZE. Attains at least 64 cm TL. Males mature at ~54 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off eastern Australia. Demersal, most common on continental slope at 250–450 m depths, but known from 145–490 m. Biology little known.

SIMILAR SPECIES. Overlaps in distribution with the Grey Skate (19.38), but lacks malar thorns, and has denticles on the ventral margin of the head (otherwise absent), a darker belly and larger claspers.

BIGHT SKATE

19.46

Dipturus gudgeri (Whitley, 1940)

NT

IDENTIFICATION. Very large skate with a rhombic disc (width less than 1.2 times length), a very elongate and narrowly pointed snout with firm rostral cartilage, lacking nuchal and malar thorns but with rosette of thorns around orbital rim in adults, tail thick-based and tapering to slender (0.7–0.8 times precloacal length in adults), and disc greenish above and distinctly greyish below. Disc thick, anterior margin deeply concave and its apex weakly angular. Snout length 6.3–8.2 times orbit length; interorbital space 1.2–1.9 times orbit length. Tooth rows in lower jaw ~44. Dorsal disc smooth in young with some denticles in large adults; no thorns on mid-disc before tail; ventrally with denticles along anterior disc margin and snout tip, elsewhere on disc smooth in young and feeble in adults. Tail short, with a slight median bulge and narrow lateral folds; thorns in 1–3 rows. Pelvic-fin anterior lobe long, exceeding posterior lobe in young. Dorsal fins rounded, raked, separated slightly; near tail tip. Pectoral-fin radials ~103–104. Predorsal vertebrae ~86.

COLOUR. Adults almost uniformly greyish green above (young often with large darker blotches); ventral surface dull greyish white, dark-edged pores poorly defined (even on snout); dorsal and caudal fins dark.

SIZE. Attains ~184 cm TL. Males mature at ~120 cm TL; young hatch at ~26 cm TL, egg cases ~19 cm long.

HABITAT AND BIOLOGY. South-West Pacific and South-East Indian Ocean; widespread off southern Australia. Demersal, on outer continental shelf and upper slope at 160–765 m depths, most common at 400–550 m. Biology not well known. Reaches maturity at ~13 years. Diet consists mainly of small bony fishes.

SIMILAR SPECIES. Overlaps in distribution at the lower limits of its depth range off southern Australia with the smaller Australian Deepwater Skate (19.32). The Bight Skate is heavier bodied and always lacks nuchal thorns (otherwise present).

NEW ZEALAND SMOOTH SKATE

19.47

Dipturus innominatus (Garrick & Paul, 1974)

NT

IDENTIFICATION. Gigantic skate with a rhombic disc (width 1.2–1.4 times length), an elongate and narrowly pointed snout with firm rostral cartilage, with or without a nuchal thorn, no malar thorns, rosette of thorns around orbital rim in adults, tail slender (0.7–0.8 times precloacal length in adults), and plain coloured or blotched dorsally and undersurface usually paler. Disc strongly depressed, anterior margin weakly double concave and its apex angular. Snout length 4.4–7.5 times orbit length; interorbital space 1.1–1.3 in young, up to 2.1 times orbit length in adults. Tooth rows in upper jaw 43–47. Dorsal skin smooth in young, but very granular in adults; usually lacking lumbar thorns; ventrally, with denticles along anterior disc margin and snout in young, becoming more widespread in adults. Tail short, depressed, with a weak median bulge; lateral folds long, narrow; thorns in single median row in males, an additional well-developed lateral row on each side in females; a few additional dorsolateral thorns sometimes present near tail base. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins rounded, separated slightly; near tail tip; caudal fin reduced. Predorsal vertebrae 83–89.

COLOUR. Adults grey to greyish brown, often mottled with white spots and darker blotches, typically embedded in dark mucous (lost when mucous removed); dorsal and caudal fins similar to body. Ventral surface usually paler, whitish to pale greyish pink; dark-edged sensory pores poorly defined (even on snout).

SIZE. Possibly attains 240 cm TL; males mature at ~150 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Zealand. Demersal on insular shelves and upper slope from nearshore to 1450 m depth. Long lived and slow growing. Diet consists mainly of benthic decapods and bony fishes.

SIMILAR SPECIES. Single member of the genus *Dipturus* in New Zealand seas. Occurs with the New Zealand Rough Skate (19.154), from which it can be distinguished by a largely smooth upper disc surface (rather than being rough) and a darker belly (rather than whitish).

FLAPPER SKATE

19.48

Dipturus intermedius (Parnell, 1837)

NE

IDENTIFICATION. Gigantic skate with a broadly rhombic disc (wider than long), long and narrowly pointed snout with firm rostral cartilage, malar thorns not developed, no nuchal thorns or thorns around orbital rim in adults, tail robust, and upper disc variably white-spotted. Disc anterior margin very deeply concave, apex angular. Snout length 3.7–5.1 and interorbital space 1–2.3 times orbit length respectively. Disc smooth in young; denticles confined to dorsal head and along anterior disc margin on both surfaces in adults. Tail moderately elongate (0.8–1 times precloacal length), lacking median bulge; 12–18 predorsal thorns in median row; adults with additional rows of forward-pointing lateral thorns. Pelvic fin short, anterior lobe much shorter than posterior lobe. Dorsal fins rounded, upright, near tail tip, separated by about half dorsal-fin base length.

COLOUR. Dark olive-green in young with small pale spots; becoming greyish brown, often with vague circular pectoral markings usually consisting of pale spots and streaks; iris of eye olive green. Undersurface greyish or whitish, small juveniles darker than adults; sensory pores appear as small black spots and streaks.

SIZE. Attains at least 230 cm TL. Males mature at ~185 cm TL, females ~197 cm TL; young hatch at ~29 cm TL from very large egg cases (up to 25 cm long).

HABITAT AND BIOLOGY. North-East Atlantic; Iceland to British Isles. Formerly more widespread, including Mediterranean Sea and North Africa; range thought to be reduced due to fishing. Demersal, from coast to upper continental slope, possibly to ~1500 m depth, most common at ~200 m. Egg cases laid during spring and summer with long embryonic development. Eats benthic invertebrates and fishes.

SIMILAR SPECIES. Confused with the smaller sympatric Common Blue Skate (19.35), but the Flapper Skate has a broader interdorsal space (exceeding 2% *vs.* usually less than 1.8% TL), more white-spotted dorsally with a weaker ocellate pectoral marking, and the iris is olive green (rather than yellowish).

TRAVANCORE SKATE

19.49

Dipturus johannisdavisi (Alcock, 1899)

DD

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width ~1.2 times length), elongate and pointed snout with firm rostral cartilage, 1 nuchal thorn, rosette of small thorns around orbital rim, tail thick (length 0.8–0.9 times precloacal length in adults), anterior pelvic-fin lobe as long or longer than posterior lobe, and both surfaces very dark. Disc not especially thick; anterior margin double concave and its apex narrowly rounded. Snout narrowly pointed, of moderate length, length 5.4–6.2 times orbit length; interorbital space narrow, 1.2–1.4 times orbit length. Tooth rows in lower jaw ~38. Dorsal disc uniformly smooth, without denticles; thorns confined to orbital and nuchal regions (malar thorns probably absent); ventrally with narrow band of denticles at snout tip and along anterior disc margin. Tail short, base almost rounded in cross-section; median bulge very prominent, often extending along much of tail; lateral folds narrow; thorns in a single median row. Pelvic-fin anterior lobe long, exceeding posterior lobe length in young. Dorsal fins rounded, upright, barely separated; near tail tip. Pectoral-fin radials 86–88. Predorsal vertebrae ~78–88.

COLOUR. Dark brown above (young not blotched), slightly darker on pelvic fins and along pectoral-fin hind margin; ventral surface darker greyish brown (darker in juveniles); sensory pores minute, barely visible even on snout; dorsal and caudal fins brownish black.

SIZE. Attains at least 54 cm TL; males at this size still immature.

HABITAT AND BIOLOGY. Indian Ocean; Bay of Bengal and India, possibly west to Tanzania. Demersal on upper continental slope at 220–660 m depths. Biology not well known.

SIMILAR SPECIES. Resembles an unidentified relative of Weng's Skate (19.68) from the Eastern Indian Ocean, but has fewer predorsal vertebrae (usually fewer than 86 *vs.* 87 or more) and the snout/orbit length ratio in adults is smaller (snout 5–6 *vs.* 7–9 times longer than orbit). The Roughbelly Skate (19.63) is very similar and their relationships need to be assessed.

KWANGTUNG SKATE

19.50

Dipturus kwangtungensis (Chu, 1960)

DD

IDENTIFICATION. Medium-sized skate with an angular rhombic disc (width ~1.2 times length), rather long and narrowly pointed snout with firm rostral cartilage, no nuchal thorns, continuous rosette of thorns around orbital rim in adults, narrow tail (0.8–1.1 times precloacal length), and upper surface heavily mottled brownish and yellowish. Disc anterior margin weakly double concave, pectoral-fin apices bluntly angular (even in small individuals), posterior margin strongly convex. Snout length 4.4–5.3 times orbit length; interorbital space 0.8–0.9 times orbit length. Tooth rows in upper jaw 34–36, lower jaw 34–35. Disc smooth above, apart from denticle patch at snout tip; ventrally, denticles over rostral cartilage and in band along head margin. No adult males examined, so malar thorn patch unknown. Tail very slender, tapering gradually, no median bulge; with well-developed posterior lateral folds; 17–21 spiny thorns in single median row. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins narrowly rounded, well separated; first located away from tail tip; caudal fin short, low. Pectoral-fin radials ~82. Predorsal vertebrae 73–79.

COLOUR. Brownish above, with dense mottled pattern of yellowish white blotches, no pectoral ocelli; dorsal and caudal fins uniformly dark, brownish to black. Ventral surface almost uniformly dark brown (often with dark mucous areas); black sensory pores distinct but not encircled by greyish blotch.

SIZE. Attains at least 50 cm TL. No reliable information on size of maturity, a male 41 cm TL was immature.

HABITAT AND BIOLOGY. North-West Pacific; South China Sea (Malaysian Borneo and Guangdong, China). Demersal on continental shelf at unknown depths. Biology little known, probably prefers sandy and muddy bottoms.

SIMILAR SPECIES. Confused with the Polkadot Skate (19.39), which occurs further north in the Western Pacific. The Kwangtung Skate has a longer snout and the pattern of blotches on the upper surface is finer and less regular.

BARNDOOR SKATE

19.51

Dipturus laevis (Mitchill, 1818)

EN

IDENTIFICATION. Very large skate with a rhombic disc (width ~1.3 times length), long and broadly pointed snout with firm rostral cartilage, dorsal disc covered with coarse denticles in adults but with few thorns (small orbital thorns present in juveniles), tail elongate, greyish or brownish above with white-edged black spots, and sensory pores on ventral surface demarcated by black dots and streaks. Disc anterior margin concave, apex narrowly rounded. Snout length ~3.6 times orbit length; interorbital space ~1.4 times orbit in subadults. Tooth rows in upper jaw 30–40. Disc entirely smooth in young; denticles covering most of dorsal surface (apart from centres of pectoral fins) in adults; ventral surface smoother, in females denticles confined to snout margin, branchial region and pelvic fins. No nuchal, scapular or lumbar thorns; adults with 22–40 predorsal tail thorns in median row (14–17 in young), and well-developed row of lateral thorns on each side. Tail rather firm and slender, lacking median bulge, length subequal to precloacal length in adults. Pelvic fin rather large, anterior lobe shorter than posterior lobe. Dorsal fins rounded, tilted, near tail tip, separated slightly. Pectoral-fin radials 83–88. Predorsal vertebrae 78–85.

COLOUR. Greyish to brown above with dense pattern of dark spots, usually with white borders; often with large and indistinct, ocellate pectoral marking. Ventrally dusky, darker near disc and pelvic–fin margins; blackish sensory pores strongly demarcated.

SIZE. Attains ~163 cm TL. Males mature at ~100 cm TL, females 96–105 cm TL; young hatch at 18–19 cm TL from medium-sized egg cases (up to 13 cm long).

HABITAT AND BIOLOGY. North-West Atlantic; North Carolina (USA) to Labrador (Canada). Demersal, mainly on continental shelf at 10–145 m depths, occasionally deeper to at least 790 m. Egg cases deposited during summer with 6-month development. Diet consists of a variety of small benthic invertebrates and bony fishes.

SIMILAR SPECIES. Where several other skates of the North-West Atlantic have sensory pores appearing as dark spots, those of the Barndoor Skate are conspicuously marked with dark spots and streaks.

RATTAIL SKATE

19.52

Dipturus lanceorostratus (Wallace, 1967)

DD

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width ~1.2 times length), elongate and very narrowly pointed snout with firm rostral cartilage, single nuchal thorn, small malar thorn patch beside eye, small incomplete rosette of thorns around orbital rim in adults, long tail (subequal to or slightly longer than precloacal length), and upper surface white-spotted. Disc anterior margin double concave, more so in adult males; its apex narrowly angular. Snout acute, length ~6 times orbit length; interorbital space ~1.3 times orbit length. Tooth rows in upper jaw ~31. Dorsal disc largely smooth, except for long and narrow band of enlarged denticles and thornlets along front margin of disc (extending from forward of eye almost to pectoral-fin apex); ventral surface with spinules over snout and along anterior disc margin. No rostral or scapular thorns; ~26 thorns in median predorsal row on tail in males and juveniles, additional lateral row on each side in adult females. Tail slender, elongate, tapering and very narrow distally, lateral fold poorly developed. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe; claspers about as long as snout, falling well short of dorsal fins. Dorsal fins small, widely separated; well forward of tail tip, procaudal length subequal to snout length; caudal fin rudimentary.

COLOUR. Dorsal surface greyish, covered with numerous small white spots; thorns and denticles much paler than skin. Ventral surface greyish, pale areas extend between gill slits and over snout; sensory pores black.

SIZE. Attains at least 82 cm TL, male holotype mature at this size.

HABITAT AND BIOLOGY. South-West Indian Ocean; off Mozambique. Demersal on upper continental slope at ~430–440 m depths. Rarely captured and little known of its biology.

SIMILAR SPECIES. Adults of the White Skate (19.143) also have a greyish white-spotted upper disc, but its snout and tail are both much shorter than in the Rattail Skate, and its sensory pores are not marked black.

THINTAIL SKATE

19.53

Dipturus leptocaudus (Krefft & Stehmann, 1975)

DD

IDENTIFICATION. Medium-sized skate (known largely from juveniles) with a broad rhombic disc (width ~1.2 times length), very elongate and narrowly pointed snout with firm rostral cartilage, 1–2 large nuchal thorns, 1–2 small thorns on each shoulder, 4–7 thin thorns around orbital rim, tail very slender, and upper disc brownish with numerous white blotches. Disc anterior margin deeply concave, undulate, its apex weakly angular. Snout length ~5.5 times orbit length; interorbital space subequal to orbit length. Tooth rows in upper jaw 29–31. Dorsal disc smooth or with scatted denticles; 0–10 median thorns (increasing in number with growth); ventral head with scattered denticles and hooked thornlets. Tail short (~0.9 times precloacal length), barely tapering, lacking a median bulge; lateral folds narrow, extending from pelvic axils to mid-caudal fin; 16–22 distinct tail thorns in single median row, scattered thornlets on sides of tail. Pelvic-fin anterior lobe long, almost equal to posterior lobe length. Dorsal fins low, raked, well separated; widely removed from tail tip. Pectoral-fin radials ~98. Predorsal vertebrae ~88.

COLOUR. Dark brown with many round, diffuse-edged whitish blotches above; disc palest beside rostral shaft; dorsal and caudal fins dark. Ventrally dark greyish and covered with black mucus; dark sensory pores inconspicuous, most prominent on snout.

SIZE. Attains at least 88 cm TL, no adults known; young hatch at ~17 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; off southern Brazil. Demersal on upper continental slope at 10–550 m depths, probably deeper and more widespread along the Brazilian slope. Known from few specimens and so biology unknown.

SIMILAR SPECIES. *Zearaja* skates, Menni's Skate (19.56) and the Roughskin Skate (19.67) from the South-West Atlantic, also have long pointed snouts. However, the tail of the Thintail Skate is relatively long with only a single thorn row (large individuals of *Zearaja* have a short tail with strong lateral thorn rows), lacks lumbar thorns (present in Menni's Skate), and the dorsal disc is smoother than in the Roughskin Skate.

BIGTAIL SKATE

19.54

Dipturus macrocaudus (Ishiyama, 1955)

DD

IDENTIFICATION. Large skate with a broad rhombic disc (width ~1.2 times length), moderately elongate and broadly pointed snout with firm rostral cartilage, usually 2 nuchal thorns, dense rosette of thorns around orbital rim, small malar thorn patch beside eye, middle of tail greatly swollen before dorsal fins in adults, and both surfaces uniformly dark greyish rather than black. Disc thickened, anterior margin undulate to strongly double concave; apex narrowly rounded (broadest in young). Snout length ~5.6 times orbit length in adults; interorbital space narrow, ~1.3 times orbit length. Disc surface largely smooth, denticles confined to snout tip and mid-anterior margins of both surfaces in adult; orbital thorns denser in adult females than males. Tail robust, oval in cross-section, tapering strongly from first dorsal fin to tip; length 0.8–0.9 times precloacal length in adults; slightly longer than disc and less swollen medially in juveniles; lateral fold narrow, widest posteriorly; tail thorns in a dense row in males, 3 rows of weak thorns in adult females. Pelvic-fin anterior lobe very broad, shorter than posterior lobe; clasper particularly stout, almost reaching dorsal fins. Dorsal fins rounded, separated slightly, located near tail tip; caudal fin reduced. Predorsal vertebrae 84–91.

COLOUR. Adults plain greyish (greyish pink on capture) on both surfaces, rather than blackish; ventral tip of snout and outer margins of pelvic fins broadly dark; no pectoral ocelli.

SIZE. Attains at least 130 cm TL; males mature at ~100 cm TL; egg capsule 13–15 cm long.

HABITAT AND BIOLOGY. North-West Pacific; China to Japan, including Taiwan. Demersal on soft substrates of upper continental and insular slopes at 300–800 m depths. Diet probably consists of invertebrates and bony fishes.

SIMILAR SPECIES. Occurs together with the Acutenose Skate (19.66) in the North-West Pacific, but can be distinguished by a broader and less narrowly pointed snout, and lacking a continuous thorn row along the middle of the disc.

BLACKTIP SKATE

19.55

Dipturus melanospilus Last, White & Pogonoski, 2008

DD

IDENTIFICATION. Medium-sized skate with a very broad rhombic disc (width exceeding 1.2 times length), elongate and pointed snout with firm rostral cartilage, lacking nuchal and malar thorns but with weak rosette around eye in adults, tail quadrangular in cross-section and very slender, and disc surfaces dusky above and below. Disc anterior margin deeply concave and its apex angular. Snout length 4.6–6.1 times orbit length; interorbital space 1.1–1.4 times orbit length. Tooth rows in lower jaw 34–37. Dorsal disc smooth in young and females; denticles present at snout tip and along head margin in adults; no thorns on mid-disc before tail; ventrally, denticles confined to anterior disc margin and snout tip. Tail rather short (0.8–0.9 times precloacal length in adults), with obscure median bulge and narrow lateral folds; thorns in single row. Pelvic fin small, anterior lobe subequal to posterior lobe in young, relatively shorter in adults. Dorsal fins rounded, raked, barely separated; barely forward of tail tip, procaudal length ~2/3 of snout length. Pectoral-fin radials 92–98. Predorsal vertebrae 77–86.

COLOUR. Adults usually uniformly greyish brown dorsally; dorsal and caudal fins dusky (black in young). Ventral surface similar, with some whitish patches on head and central disc; anterior ventral margin of disc paler than adjacent disc; sensory pores dark-edged, prominent on snout, not encircled by dusky blotches.

SIZE. Attains at least 78 cm TL. Males mature at ~63 cm TL; hatching size unknown, but newborns observed at ~20 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off eastern Australia. Demersal on upper continental slope at 240–695 m depths. Biology unknown.

SIMILAR SPECIES. Often confused with the Pale Tropical Skate (19.34) and Queensland Deepwater Skate (19.62) which all occur together in the same region of Australia. Specimens need to be examined carefully to confirm their identity.

MENNI'S SKATE

19.56

Dipturus mennii Gomes & Paragó, 2001

VU

IDENTIFICATION. Very large skate with a largely smooth, broad rhombic disc (~1.3 times length), elongate and narrowly pointed snout with broad rostral cartilage, small eye, thorns continuous from nuchal region along mid-line of disc to join tail row, 1–4 scapular thorns, rosette of 6–12 small thorns around orbital rim, tail slender (slightly shorter than precloacal length), and both dorsal and ventral surfaces dark. Disc anterior margin double concave and its apex narrowly rounded to angular. Snout length 7–9 times orbit length, interorbital space 1.7–2.1 times orbit in adult male. Tooth rows in upper jaw ~30. Dorsal disc in adult male largely smooth, apart from denticles on snout tip and interorbit; adult females with a scattering of small denticles on both surfaces, more concentrated on head; 5–8 nuchal thorns. Tail broad, but without obvious median bulge; lateral folds prominent. Tail thorns in 3 rows in adult males (lateral rows on sides of tail), usually additional pair of dorsolateral rows in large females; 25–43 closely spaced thorns in median row. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins low, rounded, separated slightly, near tail tip.

COLOUR. Uniformly dark brown on both surfaces, rostral cartilage not distinctly darker than rest of snout; thorns whitish.

SIZE. Attains ~167 cm TL; size at maturity unknown, but a 95 cm TL male was still immature.

HABITAT AND BIOLOGY. South-West Atlantic; off southern Brazil. Demersal on continental slope at 135–550 m depths. Life history unknown.

SIMILAR SPECIES. Similar to the Roughskin Skate (19.67), also from the South-West Atlantic, but has spiracular, scapular and median thorns in a row along the mid-line of the disc (otherwise absent from these regions of the disc and median thorns confined to the tail), and differs in several subtle characteristics of its clasper.

NORWEGIAN SKATE

19.57

Dipturus nidarosiensis (Storm, 1881)

NT

IDENTIFICATION. Gigantic skate with a rhombic disc (width ~1.2 times length), very elongate and narrowly pointed snout with firm rostral cartilage, small eyes, lacking nuchal and malar thorns, rosette of small thorns around orbital rim, tail short (length ~0.8 times precloacal length in adults), and plain greyish brown above and darker brown below. Disc thickened, anterior margin deeply concave and its apex angular; posterior margin strongly convex. Snout length ~7 times orbit length in adults; interorbital space ~1.3 times orbit length. Tooth rows in lower jaw 40–46. Dorsal disc entirely smooth in young, denticles developing on head and along anterior disc margin in adults; no thorns on mid-disc before tail; ventrally, densely covered with very coarse denticles. Tail thick, without a median bulge, lateral folds narrow, wider at tail end; 40–50 small median predorsal thorns, in single row in males, additional lateral rows in females. Pelvic-fin anterior lobe long, barely shorter than posterior lobe in young (much shorter in adults). Dorsal fins rounded, separated slightly; procaudal length ~3/4 snout length.

COLOUR. Uniformly dark greyish brown dorsally, dorsal and caudal fins darker than adjacent tail (more obvious in young). Ventral surface of disc usually darker than upper surface, brownish and often covered with black mucus; sensory pores dark-edged, not encircled by greyish blotch.

SIZE. Attains at least 200 cm TL (possibly to 250 cm TL). Sizes of maturity and hatching unknown; egg cases ~26 cm long.

HABITAT AND BIOLOGY. Eastern Atlantic; Iceland to South Africa, including Mid-Atlantic Ridge. Demersal on continental and insular shelves and slopes at 125–1420 m depths, probably most common on the mid-slope. Diet consists of invertebrates and small fishes.

SIMILAR SPECIES. Once thought to be confined to the North-East Atlantic, but molecular analyses indicate that it also occurs off Morocco and South Africa, where it has been confused with the Roughbelly Skate (19.63) from the Indian Ocean.

SPREADFIN SKATE

19.58

Dipturus olseni (Bigelow & Schroeder, 1951)

DD

IDENTIFICATION. Medium-sized skate with a broad, smooth, weakly rhombic disc (width 1.2–1.3 times length), moderately elongate and narrowly pointed snout with firm rostral cartilage, no nuchal or malar thorns, few thorns around orbital rim, long and very slender tail (only slightly shorter than precloacal length) with widely separated dorsal fins, and upper surface of disc finely spotted. Disc anterior margin undulate to weakly concave, apex broadly rounded (juveniles) to abruptly angular (adult males). Snout length 3.6–4.1 times orbit length; interorbital space narrow, 0.8–1 times orbit length. Tooth rows in upper jaw 34–41. Disc entirely smooth dorsally; ventral surface with denticles confined to mid-snout and along anterior margins of disc. Tail lacking median bulge, lateral folds long but not reaching tail tip. Tail thorns thin and sharp, in 3 rows; lateral rows irregular and widely spaced; 13–26 median thorns before dorsal fins. Pelvic-fin anterior lobe long, about equal in length to posterior lobe. Dorsal fins narrow, strongly tilted, separated by about base length of first dorsal fin; positioned well forward of tail tip, procaudal length subequal to prespiracular distance; caudal fin long based.

COLOUR. Dark brownish to olive brown dorsally, covered with minute darker spots (often indistinct); sensory pores whitish. Ventral surface dark, greyish to almost black; sensory pores dark-edged.

SIZE. Attains at least 69 cm TL. Males mature at ~51 cm TL, females ~59 cm TL; hatching size unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Mexico. Demersal on outer continental shelf and upper slope at 55–385 m depths. Biology not well known.

SIMILAR SPECIES. Resembles the much larger Barndoor Skate (19.51), but has more widely separated dorsal fins, a rougher ventral head, and relatively shorter lateral folds (falling short of the tail tip rather than reaching the tip in the Barndoor Skate).

HOOKTAIL SKATE

19.59

Dipturus oregoni (Bigelow & Schroeder, 1958)

DD

IDENTIFICATION. Large skate with a very broad rhombic disc (width 1.3–1.4 times length), moderately elongate and pointed snout with firm rostral cartilage, no median thorns on disc forward of tail, small rosette of thorns around orbital rim, long and rather broad tail (subequal to precloacal length in adults), and plain coloured upper surface. Disc anterior margin deeply concave, apex acute in adults. Snout length ~6.2–7 times orbit length; interorbital space broad, ~2.8 times orbit length. Tooth rows in lower jaw 33–34. Disc dorsal surface smooth, apart from band of denticles, thornlets and small malar thorns along anterior margins in adult males (usually naked in females and juveniles); no nuchal, lumbar or scapular thorns. Ventrally smooth, apart from snout and along anterior margins of disc. Tail of moderate length, wide but lacking median bulge, lateral folds narrow; thorns hook-shaped, in 3 widely spaced rows; 31–48 closely spaced median thorns before dorsal fin, lateral thorns regular and also closely spaced. Pelvic-fin anterior lobe long, ~3/4 length of posterior lobe. Dorsal fins tilted, separated slightly; relatively close to tail tip, procaudal length much shorter than snout; caudal fin short based, low.

COLOUR. Plain brownish dorsally. Ventral surface bluish grey to pale brown; sensory pores dark-edged, most evident on head.

SIZE. Attains at least 144 cm TL. Males mature from ~107 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; northern Gulf of Mexico to eastern Florida (USA). Demersal on upper and mid-continental slope at 475–1080 m depths. Biology not well known.

SIMILAR SPECIES. The Spreadfin Skate (19.58), which also occurs in the Gulf of Mexico, has a largely smooth upper disc without denticles, and thorns confined to the orbital and alar regions (in adult males). The Hooktail Skate has a more angular disc, and a broader tail with its dorsal fins closer together and nearer the tail tip.

SHARPNOSE SKATE

19.60

Dipturus oxyrinchus (Linnaeus, 1758)

NT

IDENTIFICATION. Large skate with a smooth, strongly rhombic disc, very deeply concave anterior margin (width ~1.1 times length), very elongated and narrowly pointed snout with firm rostral cartilage, tail medium-sized (~0.8 times precloacal length in adults), and both upper and lower surfaces plain brownish or greyish. Disc very deeply concave anteriorly, pectoral-fin apex very narrow and angular, posterior margin very convex. Snout length ~7 times orbit length; interorbital space ~1.1 times orbit length. Tooth rows in lower jaw 32–42. Both sides of disc entirely smooth in young, becoming almost entirely covered with denticles in adults (pectoral-fin centres sometimes naked). No thorns on disc, except for small preorbital thorns in juveniles and alar patch in adult males. Tail slender, without a median bulge, lateral folds poorly developed; 4–11 median predorsal thorns (small and often worn off in adults); thorns in a single row in males, often additional shorter lateral row on each side in females. Pelvic-fin anterior lobe short, shorter than posterior lobe. Dorsal fins rounded, raked, separated slightly, well forward of tail tip.

COLOUR. Greyish to brownish dorsally, often covered with widely spaced light and dark spots; young paler, large adults sometimes darker bluish grey. Ventrally, dark brown to bluish grey (often with darker mucous patches); sensory pores very dense, dark-edged and conspicuous, but not encircled by greyish blotch.

SIZE. Attains ~150 cm TL. Males mature at 70–80 cm TL, females ~90 cm TL; young hatch at ~17 cm TL.

HABITAT AND BIOLOGY. North-East and Eastern Central Atlantic; Norway to Senegal, including Mediterranean Sea. Demersal on continental shelf and slope at 70–1230 m depths, most common at ~200 m. Breeds in spring and early summer. Diet consists mainly of cephalopods and crustaceans.

SIMILAR SPECIES. Has a more deeply concave anterior disc and narrower snout than the similar Norwegian Skate (19.57). The Rattail Skate (19.52) is white-spotted above, but has a more slender tail with more forwardly positioned dorsal fins. Probably a composite taxon consisting of a small and a large species.

SLIME SKATE

19.61

Dipturus pullopunctatus (Smith, 1964)

LC

IDENTIFICATION. Large skate with a broad and weakly rhombic disc (width 1.2–1.4 times length), moderately elongate and bluntly triangular snout with firm rostral cartilage, large nuchal thorn, 3–8 spiny thorns around orbital rim, no granular denticles along anteroventral margin of disc, narrow tail with weak bulge distally (length subequal to precloacal length), and pattern of dark spots and pair of irregular blotches on upper disc. Disc anterior margin undulate in young, much more so in adults; pectoral apices broadly to narrowly rounded. Snout tip extended, narrowly rounded, length ~3.6–3.7 times orbit length, interorbital space 1–1.2 times orbit length. Tooth rows in upper jaw ~53–58. Skin of females and young smooth. Thorns long, slender around eyes and on nuchal area; no scapular or rostral thorns; existence of malar thorns unknown. Tail with narrow lateral folds, not obviously swollen; up to 27 tail thorns commencing over cloaca and to dorsal fins in adults. Pelvic fins large, anterior lobe much shorter than posterior lobe; adult male clasper unknown. Dorsal fins broadly rounded, separated by about half first dorsal-fin base length; close to tail tip; caudal fin rudimentary.

COLOUR. Brownish or yellowish with prominent pectoral marking consisting of large dark brown irregular blotch; juveniles covered with numerous black spots, becoming inconspicuous or lost in adults; adults sometimes with small white spots and pale blotches. Ventral surface greyish white; sensory pores grey or black.

SIZE. Attains ~130 cm TL. Males mature at 88–96 cm TL, females possibly slightly larger off western than southern coast of South Africa; young hatch at ~19 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; southern Africa, Namibia to Eastern Cape (South Africa). Demersal on continental shelf and upper slope at 30–385 m depths. Feeds mainly on small bony fishes, crustaceans and molluscs.

SIMILAR SPECIES. The smaller Blackspot Skate (19.37) also has a dorsal surface covered with black spots. However, it lacks a large brown pectoral marking, the anterior edge of disc is rougher underneath, and its tail is thicker at its mid-length than at its base (rather than gradually tapering).

QUEENSLAND DEEPWATER SKATE

19.62

Dipturus queenslandicus Last, White & Pogonoski, 2008

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc (width less than 1.2 times length), very elongate and narrowly pointed snout with firm rostral cartilage, small eyes, usually 1–2 nuchal thorns (sometimes absent), malar thorn patch well developed, rosette of thorns around orbital rim in adults, tail almost oval in cross-section and slender (0.7–0.9 times precloacal length in adults), and disc uniformly brownish above. Disc anterior margin very deeply double concave, its apex narrowly rounded. Snout length 8.8–9.1 times orbit length; interorbital space 1.3–1.5 times orbit length. Tooth rows in lower jaw 32–39. Dorsal disc smooth in young and females, denticles along head margins in adults; smooth ventrally apart from denticles at snout tip and along anterior disc margin to level of mouth. No scapular or lumbar thorns. Tail of moderate length, barely tapering, without median bulge; lateral folds well-developed; thorns in single row in adult males and juveniles, with additional 1–2 rows in adult females. Pelvic fin medium-sized, anterior lobe shorter than posterior lobe. Dorsal fins broadly rounded, upright, close together; caudal fin low, elongate. Pectoral-fin radials 77–80. Predorsal vertebrae 74–89.

COLOUR. Adults uniformly greyish brown dorsally; ventral surface greyish or brownish, often blotched, snout tip pale; sensory pores small, black-edged, conspicuous, not encircled by dusky blotch. Dorsal fins blackish, caudal fin pale.

SIZE. Attains at least 76 cm TL. Males mature at ~63 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off Queensland (Australia). Demersal on upper continental slope at 400–605 m depths. Biology unknown.

SIMILAR SPECIES. The Blacktip Skate (19.55) also lacks a nuchal thorn, but the Queensland Deepwater Skate has a much longer snout and narrower disc, paler upper caudal-fin lobe, and a malar thorn patch in adult males.

ROUGHBELLY SKATE

19.63

Dipturus springeri (Wallace, 1967)

DD

IDENTIFICATION. Very large skate with an extremely broad, rhombic disc (width 1.3–1.4 times length), elongate and narrowly pointed snout with firm rostral cartilage, lacking nuchal thorns but with weak rosette (5–7 thorns) around eye in adults, tail weakly depressed and very slender, and disc dark both above and below. Disc anterior margin deeply concave beside gills; apex angular. Snout angle ~85 degrees; length ~7 times orbit length; interorbital space ~1.5 times orbit length. Tooth rows in lower jaw 35–43. Dorsal disc largely smooth, denticles confined to snout and head margin; ventrally with denticles over entire disc (coverage weaker in juveniles). No thorns on mid-disc before tail. Tail rather short (0.8–0.9 times precloacal length in adults), swollen slightly before dorsal fins, lateral fold well developed near dorsal fins; tail thorns ~15, in single predorsal median row. Pelvic fin small; anterior lobe long, length subequal to posterior lobe length. Dorsal fins rounded, tilted, bases separated slightly; first dorsal well forward of tail tip. Pectoral-fin radials 105–106.

COLOUR. Dorsal surface uniformly dark greyish brown to black, ventral surface similar, often more greyish; sensory pores small, dark-edged, prominent on snout but not encircled by dusky blotches; dorsal and caudal fins dark, noticeably darker than the tail in juveniles.

SIZE. Attains ~192 cm TL. Males mature at 125–135 cm TL, females 170–190 cm TL. Smallest known specimen 27 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic and Indian Ocean; Namibia to India. Demersal on outer continental shelf and upper slope at 50–970 m depths, most common at 400–500 m. Caught rarely, so probably lives on hard bottoms that are seldom trawled. Diet consists of small bony fishes, crabs and squids.

SIMILAR SPECIES. A rough undersurface combined with relatively long anterior pelvic-fin lobes distinguishes this species from other southern African *Dipturus*, apart from the Norwegian Skate (19.57). The Roughbelly Skate has a relatively wider disc than the Norwegian Skate.

PROWNOSE SKATE

19.64

Dipturus stenorhynchus (Wallace, 1967)

DD

IDENTIFICATION. Medium-sized to large skate with a rhombic disc (width ~1.2 times length), very elongate and broad wedge-shaped snout with firm rostral cartilage, largely smooth on dorsal surface of disc, rosette of 9–11 thorns around orbital rim, tail moderately elongate (~0.8 times precloacal length in adults), and plain greyish on both surfaces. Disc anterior margin very deeply concave, pectoral apex narrowly rounded to angular. Snout length 5.4–8 times orbit length, longest in large adults; interorbital space 1.1–1.2 times orbit length. Tooth rows in lower jaw ~38. Dorsal disc almost entirely smooth, denticles confined to snout tip; usually with single nuchal thorn; ventral surface with denticles confined to skin over rostral cartilage and along anterior margins. Tail thick, fleshy, with an obvious median bulge; lateral folds well developed, broadest near dorsal fins; ~35 thorns in a single, regular median row in females, sometimes with a few additional lateral thorns near tail base. Pelvic-fin anterior lobe almost as long as posterior lobe. Dorsal fins raked, well separated, and rather well forward of tail tip; caudal fin long, low.

COLOUR. Uniformly dark greyish on both surfaces, not markedly paler dorsally beside rostral cartilage; dorsal fins and anterior pelvic-fin lobes black, posterior lobes often with white bases and black tips. Sensory pores on undersurface dark-edged, not encircled by greyish blotch.

SIZE. Attains at least 101 cm TL. Males mature at ~83–98 cm TL; smallest known specimen 24 cm TL; young possibly hatch at ~24 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; Mozambique and South Africa. Demersal on upper and mid-continental slope at 255–760 m depths. Poorly known, based on few specimens.

SIMILAR SPECIES. Resembles the Sharpnose Skate (19.60), but has a much broader triangular snout and wider tail that thickens immediately before the dorsal fins.

CARIBBEAN SKATE 19.65

Dipturus teevani (Bigelow & Schroeder, 1951)

DD

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width 1.2–1.3 times length), elongate and narrowly pointed snout with firm rostral cartilage, no median thorns forward of tail, thorns forming incomplete rosette around eye, tail moderately elongate (length usually 0.8–1 times precloacal length in adults), and dorsal surface plain coloured. Disc anterior margin undulate to strongly concave, apex narrowly rounded to abruptly acute, posterior margin strongly convex. Snout length 4.1–6.9 times orbit length; interorbital space 1–1.3 times orbit length. Tooth rows in lower jaw 28–38. Upper surface with denticles on head, most of tail, and dorsal fins; ventrally, denticles present on mid-snout and anterior margins of disc. Thorn patches of adult males unknown. Tail slender with median bulge, lateral folds well developed. Tail thorns in single median row in males, 15–24 broad-based thorns before first dorsal fin; number of thorn rows in adult females unknown; orbital thorns 2–7. Pelvic-fin small, anterior lobe longer than posterior lobe. Dorsal fins rounded, joined basally; near tail tip, procaudal length ~2/3–3/4 of snout length; caudal fin with long-based dorsal lobe. Claspers of adult male very long, slender, almost reaching first dorsal fin.

COLOUR. Pale brownish dorsally, darker on outer posterior disc, pelvic fins and tail; translucent beside rostral shaft; dorsal and caudal fins black. Ventral surface whitish to dusky, darkest posteriorly; sensory pores dark-edged on undersurface of snout.

SIZE. Attains at least 84 cm TL. Males mature at ~63 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina (USA) to middle Brazil, including Gulf of Mexico. Demersal on upper continental slope at 310–940 m depths, possibly to 1900 m. Biology not well known.

SIMILAR SPECIES. Within the region, resembles the Spreadfin (19.58) and Hooktail (19.59) Skates in lacking thorns along the mid-region of disc. However, it has only a single row of thorns on the tail, whereas the other species both have 3 rows.

ACUTENOSE SKATE

19.66

Dipturus tengu (Jordan & Fowler, 1903)

DD

IDENTIFICATION. Large skate with a broad rhombic disc (width 1.2–1.3 times length), elongate and broadly pointed snout with firm rostral cartilage, nuchal thorns almost connected to lumbar series, multi-row rosette of orbital thorns in adults, short malar thorn patch present, tail stiffened (length 0.7–1.2 times precloacal length, shortest in adults), and disc surfaces dark above and below. Disc anterior margin undulate to deeply concave, apex narrowly rounded to angular in adults. Snout slightly longer in adult females than males, length 4–8 times orbit length; interorbital space 1–1.8 times orbit length. Dorsal surface of snout and entire ventral head covered with minute denticles in adults (in young confined ventrally to anterior disc margins and median snout). Rostral thorns absent, 1–6 nuchal thorns, 1–2 small scapular thorns in adults. Tail thorns long, in single row in adult males and juveniles; smaller, hooked, in 3 densely packed rows in adult females. Tail rather broad based, tapering strongly beyond base, of moderate length, without median bulge; lateral folds narrow. Pelvic fins short, anterior lobe shorter than posterior lobe. Dorsal fins narrow, raked, well separated, well forward of tail tip, procaudal length subequal to snout length. Predorsal vertebrae 77–82.

COLOUR. Uniformly medium greyish or brownish, pale beside rostral cartilage; dorsal fins blackish. Ventral surface darker grey, but pelvic fins not darker than disc; sensory pores small, dark, usually encircled by small dusky blotch on snout; tail dark brown with a white edge.

SIZE. Attains at least 113 cm TL; egg cases 9–10 cm long.

HABITAT AND BIOLOGY. North-West Pacific; northern Philippines to Japan, including Taiwan. Demersal on mid-continental and insular shelves and upper slopes at 45–400 m depths. Feeds on invertebrates and small bony fishes.

SIMILAR SPECIES. In the North-West Pacific, the Ridgeback (19.33) and China (19.69) Skates are very similar in appearance, but have 2 parallel median rows (or a staggered row) of lumbar thorns on the disc, rather than thorns being in a single straight row.

ROUGHSKIN SKATE

19.67

Dipturus trachydermus (Krefft & Stehmann, 1974)

VU

IDENTIFICATION. Gigantic skate with a broad rhombic disc (1.2–1.4 times length), elongate and narrowly pointed snout with a broad rostral cartilage, very small eyes, no distinct thorns on upper disc but both surfaces set with coarse spiny denticles, tail slender (length 0.8–0.9 times precloacal length in adults), and both dorsal and ventral surfaces dark. Disc robust, anterior margins concave; its apex narrowly rounded to angular. Snout length 6.4–8.6 times orbit length; interorbital space 2.2–2.6 times orbit length. Tooth rows in upper jaw 36–44. Dorsal disc almost entirely covered with widely spaced denticles in young; denticles absent from mid-pectoral fins in large individuals; largest over rostral cartilage (rough to touch); ventrally, denticles densest on snout. Thornlets present on snout tip; tail with 24–43 median thorns and paired lateral rows in adults of both sexes; females usually with mid-lateral rows. Tail almost round in cross-section without pronounced median bulge; lateral folds very well developed on dorsoventral surface. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins rounded, raked, barely separated; procaudal length much shorter than snout. Pectoral-fin radials 89–99. Predorsal vertebrae 84–91.

COLOUR. Uniformly dark brownish dorsally. Ventral surface dark reddish brown to black; only gill slits, cloaca and mouth whitish; sensory pores dark but obscured by dark skin and black mucus.

SIZE. Attains ~264 cm TL. Males mature at ~186 cm TL, females at ~200 cm TL; egg cases ~20–23 cm long.

HABITAT AND BIOLOGY. South-West Atlantic and South-East Pacific; Chile to Uruguay and possibly southern Brazil (distribution probably continuous between oceans). Demersal, mainly on sandy and muddy bottoms of outer continental shelf and upper slope at 85–480 m depths (sometimes shallower, 20 m). Reaches maturity at ~13 years. Diet consists mainly of bony fishes and crustaceans.

SIMILAR SPECIES. Confused off South America with smaller skates of the genus *Zearaja*. The Roughskin Skate has relatively smaller eyes and rougher skin than those skates.

WENG'S SKATE

19.68

Dipturus wengi Séret & Last, 2008

LC

IDENTIFICATION. Large skate with a broad rhombic disc (width exceeding 1.2 times length), moderately elongate and pointed snout with firm rostral cartilage, small eyes, with or without a nuchal thorn, usually 3 thorns around orbital rim, no malar thorns, tail thick (0.7–0.9 times precloacal length in adults), and both surfaces dark. Disc thickened, anterior margin concave, its apex narrowly rounded and posterior margin very convex. Snout length 7–9.1 times orbit length in adults; interorbital space wide, 1.7–2.4 times orbit length. Tooth rows in upper jaw 34–39. Dorsal disc uniformly smooth, without denticles; ventrally, with denticles along anterior disc margin and over rostral cartilage, some denticles on belly of large females. Thorns on disc confined to orbit and sometimes nuchal area; thorns in single row on tail. Tail short, almost rounded in cross-section; median bulge prominent; lateral folds poorly developed in adults. Pelvic-fin anterior lobe usually longer than posterior lobe (except in adult males); adult male clasper not greatly enlarged, tip well short of dorsal fins. Dorsal fins rounded, raked, barely separated; near tail tip. Pectoral-fin radials 95–99. Predorsal vertebrae 87–90.

COLOUR. Greyish brown to dark brown above (not blotched), darkest along pectoral-fin hind margins and on mid-snout; dorsal and caudal fins dusky (darkest in young). Ventral surface similar to dorsal surface, often slightly darker; sensory pores not dark-edged, barely visible even on snout.

SIZE. Attains ~128 cm TL. Males mature at ~108–112 cm TL; young hatch at ~20 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; Queensland to Tasmania (southern Australia). Demersal, on upper and mid-continental slope at 485–1165 m depths, most common at 600–1000 m. Biology not well known. Diet of adults probably consists mainly of bony fishes.

SIMILAR SPECIES. Resembles the larger Giant Skate (19.44), but has a larger snout/eye ratio in adults, smoother upper disc in juveniles and adults, and fewer vertebrae.

CHINA SKATE

19.69

Dipturus wuhanlingi Jeong & Nakabo, 2008

DD

IDENTIFICATION. Medium-sized skate with a broad, largely smooth rhombic disc (width ~1.2 times its length), moderately elongate and narrowly pointed snout with firm rostral cartilage, 4–9 orbital thorns, 3–4 nuchal thorns and strong scapular thorn on each shoulder, no malar thorns, staggered row of lumbar thorns on posterior disc, single row of tail thorns in females, no denticles along front margins of dorsal disc, uniformly brownish dorsally, and rather thin tail (length ~0.8 times precloacal length). Disc anterior margins weakly double concave; pectoral apices abruptly angular. Snout length 6–7.5 times orbit length; interorbital space 1.5–1.8 times orbit length. Tooth rows in lower jaw ~32–37. Disc smooth dorsally; ventral denticles present on snout mid-line and along anterior disc margin. Tail stiffened, suboval in cross-section, with poorly developed lateral folds and no obvious median bulge; thorns in single median row in both sexes. Pelvic fin medium-sized, anterior lobe slightly shorter than posterior lobe. Dorsal fins tilted, well separated and well removed from tail tip; caudal fin low, long based. Pectoral-fin radials ~92. Predorsal vertebrae ~74.

COLOUR. Uniformly brownish, slightly paler beside mid-snout. Ventral surface pale brown; sensory pores dark-edged, not encircled by greyish blotch.

SIZE. Attains at least 78 cm TL, possibly much larger. Males still not mature at 67 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; South and East China Seas (China). Demersal, capture depth unknown but probably continental slope below 200 m. Landed infrequently at regional fish markets with few retained by museums. Life history unknown.

SIMILAR SPECIES. Most similar to the Ridgeback Skate (19.33), but differs in meristics, has less well-developed lumbar thorns, and only a single thorn row on the tail of females (rather than thorns in 3 well-developed rows).

KOREAN SKATE

19.70

Hongeo koreana (Jeong & Nakabo, 1997)

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc (width 1.1–1.2 times length), short and rather obtuse snout with slender but firm rostral cartilage, rather large eyes, single row of tail thorns in both sexes with some thorn tips directed anteriorly, and upper disc with 4 dark ocellate pectoral markings with undulate edges. Disc anterior margin double concave; pectoral apices narrowly rounded to abruptly angular. Snout length 2.3–3.3 times orbit length; interorbital space subequal to orbit length. Tooth rows in upper jaw 46–56. Disc surface largely smooth, denticles largely confined to margin of snout on dorsal surface and ventrally on snout. Thorns in rosette around eye, 2–3 in nuchal region, malar thorns in adult males; no lumbar or scapular thorns. Tail short, depressed and rather broad (0.7–0.9 times precloacal length), with well-developed lateral folds, no median bulge, and with a groove along ventral mid-line; 20–33 thorns and thornlets in a single row, their tips directed both forward and backward; well-developed triangular patch before first dorsal fin. Pelvic fin small, anterior lobe much shorter than posterior lobe. Dorsal fins short and broadly rounded, separated slightly, procaudal length about equal to preoral length; caudal fin rudimentary. Pectoral-fin radials 87–90. Predorsal vertebrae 81–85.

COLOUR. Disc brownish above, covered with numerous small dark brownish spots; central pectoral ocelli consisting of pair of longitudinally elongate greyish blotches with undulate blackish margins; another pair of dark rounded markings near insertions of pectoral fins. Ventral surface of disc blackish brown centrally, sensory pores dark, well developed; outer disc margin and tail mostly pale.

SIZE. Attains ~84 cm TL; males mature at ~60 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; off Korea and Japan. Demersal inshore on continental shelf at 30–80 m depths.

SIMILAR SPECIES. Unique within the family, particularly in the form of its denticles and unusual pectoral markings. Molecular analyses also support placement in a genus by itself.

SANDY SKATE

19.71

Leucoraja circularis (Couch, 1838)

EN

IDENTIFICATION. Large skate with a subrhombic disc (width 1.1–1.2 times length), short snout with firm rostral cartilage, medium-sized eyes (orbit length 4.3–4.9% TL), up to 5 rostral thorns, rosette of ~8 orbital thorns, triangular patch of 20–30 thorns on nape-shoulder region, slender tail (1.1–1.3 times precloacal length), and several pairs of small circular creamy spots with dusky margins. Disc anterior margin undulate to weakly concave, its apex broadly rounded. Snout length 2–2.6 and interorbital space 0.7–0.9 times orbit length respectively; its tip weakly projecting. Tooth rows in upper jaw 64–84. Dorsal disc almost entirely set with dermal denticles, sometimes bare on pelvic fins and near mid-body; ventrally, largely smooth except for snout, anterior disc margins and edges of tail, and sometimes whole mid-body. Tail tapering gradually; lateral folds on last quarter of tail; 3–5 rows of tail thorns, median row present only in juveniles. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins about half as high as long, confluent or with short thornless interspace; caudal fin ~1/3 of first dorsal-fin base length. Pectoral-fin radials 90–91. Predorsal vertebrae 107–118.

COLOUR. Dorsal surface pale reddish to dark brown with 4–6 main pairs of small creamy spots (often with up to additional 15 smaller lateral spots), each with darker dusky margins; spots arranged symmetrically on pectoral fins and posterior pelvic-fin lobes. Ventral surface whitish, except for dusky margins of pectoral and pelvic fins.

SIZE. Attains ~120 cm TL. Males are mature at ~66 cm TL, females still immature at ~76 cm TL; egg cases ~8–9 cm long.

HABITAT AND BIOLOGY. North-East Atlantic; Mauritania to Iceland and Norway, including Mediterranean Sea. Demersal on sandy and muddy bottoms of outer continental shelf and upper slope at 50–800 m depths, rarely on inner shelf. Biology poorly known, eggs laid from August to November. Feeds on mixed benthic invertebrates and small bony fishes.

SIMILAR SPECIES. It resembles the much smaller Freckle Skate (19.76) from the Western Central Atlantic, but has a shorter tail, different dorsal coloration, and higher tooth row counts in the upper jaw.

TIGERTAIL SKATE

19.72

Leucoraja compagnoi (Stehmann, 1995)

DD

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width ~1.2 times length), short snout with firm rostral cartilage, medium-sized eyes (orbit length ~4.5% TL), dorsal surface spiny with rosette of 4 orbital thorns, 4 nuchal thorns, triangular patch of thorns on nape-shoulder region, stiffened tail (~1.4 times precloacal length), and medium brown dorsal coloration with darker bands on tail. Disc anterior margin weakly convex, its apex broadly rounded. Snout anterior angle obtuse (~111°), length ~2.8 interorbital width; its tip prominent. Eyes close-set, orbit length ~1.2 times interorbital width. Tooth rows in upper jaw ~38. Dorsal disc covered with coarse, spiny denticles; ventral surface smooth. Large thornlets on snout tip, along rostrum, and in narrow band along most of anterior disc margin; band of enlarged thorns (mainly in 3 rows) extending along mid-disc and over most of dorsal tail; scattered on sides of tail, its lower edges with hooked thornlets; dorsal and upper caudal fins loosely set with fine prickles. Tail tapering strongly from base; lateral folds weak, confined to posterior third of tail. Pelvic-fin anterior lobe slightly shorter than posterior lobe. Dorsal fins about half as high as long and confluent; caudal fin about half of first dorsal-fin base length.

COLOUR. Dorsal surface medium brown, tail with broad dark brownish bands. Ventral surface white.

SIZE. Attains at least 52 cm TL (adolescent male). Smallest known specimen 14 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; off South Africa. Demersal on upper continental slope at 480–625 m depths. No information available on habitat or biology.

SIMILAR SPECIES. Appears similar to the Munchkin Skate (19.128), but differs in general disc shape (particularly a narrower snout angle), and having relatively longer anterior pelvic lobes.

LITTLE SKATE

19.73

Leucoraja erinacea (Mitchill, 1825)

NT

IDENTIFICATION. Medium-sized skate with a weakly rhombic to heart-shaped disc (width 1.2–1.3 times length), short snout with firm rostral cartilage, small eyes (orbit length 3.6–3.8% TL), rosette of 9–12 orbital thorns, numerous nuchal thorns, triangular patch of 20–60 thorns on nape-shoulder region, stiffened tail (1–1.3 times precloacal length), and upper surface covered with small dark spots. Disc anterior margin undulate (double concave in adult males), its apex broadly rounded. Snout length 2.7–2.8 and interorbital space 1.3 times orbit length respectively; its tip weakly projecting. Tooth rows in upper jaw 30–66. Skin very rough above, covered with numerous thorns and thornlets, but without small denticles; ventral surface largely smooth, but anterior disc margins prickly in adults. Tail tapering gradually; lateral folds on posterior 2/3 of tail; 3–5 rows of tail thorns, median row reduced with growth. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about half as high as long and confluent; caudal-fin base length ~1/3 of first dorsal-fin base length. Pectoral-fin radials 63–67. Predorsal vertebrae 80–88.

COLOUR. Dorsal surface greyish to dark brown or cloudy with lighter and darker areas; covered with dense pattern of small dark spots, usually without ocelli. Ventral surface white to pale grey, sometimes with irregular dusky blotches and/or tail grey.

SIZE. Attains ~62 cm TL. Males mature at 36–44 cm TL, females 32–48 cm TL, size of maturity increases with latitude. Young hatch at 8–10 cm TL; egg cases ~6 cm long.

HABITAT AND BIOLOGY. North-West Atlantic; Newfoundland (Canada) to North Carolina (USA). Mainly benthic on sand and gravel bottoms (less common on mud or rock) on continental shelf at 10–110 m depths, questionably to 915 m. Breeds all year round, females produce 28–33 egg cases annually. Feeds on benthic invertebrates, mainly crustaceans and small bony fishes.

SIMILAR SPECIES. Resembles the sympatric Winter Skate (19.80), but differs in having a smaller maximum size (to 62 cm *vs.* longer than 100 cm TL) and fewer tooth rows.

SHAGREEN SKATE

19.74

Leucoraja fullonica (Linnaeus, 1758)

VU

IDENTIFICATION. Large skate with a rhombic disc (width 1.2 times length), short snout with firm rostral cartilage, medium-sized eyes (orbit length 4.2–4.5% TL), up to ~10 rostral thorns, rosette of ~8–11 orbital thorns, 3–9 thorns in median row on nape but no triangular patch on nape-shoulder region, stiffened tail (1.2 times precloacal length), and plain greyish above or with inconspicuous dark horizontal bands. Disc anterior margin undulate (double concave in adult males), its apex narrowly rounded or angular. Snout length 2.4–2.5 and interorbital space 0.8–0.9 times orbit length respectively; its tip moderately pronounced. Tooth rows in upper jaw 58–68. Dorsal disc entirely set with dermal denticles in young, centres of pectoral fins bare in large adults; ventral surface mostly prickly, except for posterior disc. Tail tapering strongly; lateral folds on posterior 3/4 of tail; 3 rows of tail thorns, median row reduced or disappearing with age. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about half as high as long and confluent or with short, thornless interspace; caudal-fin base length exceeding half of first dorsal-fin base length. Pectoral-fin radials 86–88. Predorsal vertebrae 106–114.

COLOUR. Plain greyish above; darker lines and horizontal wavy bands often present on dorsal surface, usually most pronounced in juveniles. Undersurface white, margins of pectoral fins and posterior pelvic-fin lobes pale greyish.

SIZE. Attains ~120 cm TL, usually smaller than 80 cm TL. Males mature at 75–81 cm TL, largest immature female 82 cm TL. Hatching size unknown; egg cases ~8 cm long.

HABITAT AND BIOLOGY. North-East Atlantic; Morocco to Iceland and Norway, including Mediterranean Sea. Demersal on outer continental shelf and upper slope at 30–600 m depths, occasionally on inner shelf. Biology poorly known. Feeds on various benthic invertebrates, including bony fishes as adults.

SIMILAR SPECIES. Distinguishable from other species of *Leucoraja* by the absence of a distinctive triangular patch of thorns on the nape-shoulder region, and having more angular pectoral-fin apices.

ROSETTE SKATE

19.75

Leucoraja garmani (Whitley, 1939)

LC

IDENTIFICATION. Medium-sized skate with a heart-shaped disc (width 1.1–1.3 times length), short snout with firm rostral cartilage, small to large eyes (orbit length 3.6–5.4% TL), rosette of orbital thorns, triangular patch of thorns on nape-shoulder region, firm tail (1.4–1.5 times precloacal length), and greyish to brownish dorsal coloration with symmetrical pattern of rosette-like blotches. Disc anterior margin undulate, its apex broadly rounded. Snout obtuse, length 1.8–2.6 and interorbital space 0.5–0.9 times orbit length respectively; its tip projecting slightly. Tooth rows in upper jaw 44–55. Skin of upper disc almost completely spinulose in juveniles, becoming largely smooth with few remaining patches of denticles in adults; smooth ventrally. Thorns in band of 2–5 rows along mid-disc and tail, median thorn row partially lost with growth in some individuals. Tail rather broad based, tapering gradually; lateral folds narrow, extending along posterior 2/3 of tail. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about half as high as long, separated by short interspace and with 1–2 thorns; caudal-fin base ~1/3–2/3 of first dorsal-fin base length. Pectoral-fin radials 61–67. Predorsal vertebrae 80–89.

COLOUR. Dorsal surface greyish to brownish, with pattern of nearly symmetrically arranged rosette-like blotches and dark spots; blotches large, consisting of dark spots around a central spot; 6–8 narrow cross-bands on tail. Ventral surface whitish, occasionally with greyish brown blotches.

SIZE. Attains ~57 cm TL. Matures at 25–44 cm TL in both sexes, maturity size increases with latitude. Young hatch at ~8–9 cm TL.

HABITAT AND BIOLOGY. North-West Atlantic; Massachusetts to Florida (USA). Demersal on continental shelf and upper slope at 35–530 m depths. Habitat and biology poorly known. Feeds on various benthic invertebrates and small bony fishes.

SIMILAR SPECIES. Variable skate and two subspecies (*L. garmani caribbaea* and *L. garmani virginica*) were once thought to be valid species. Resembles the Freckle Skate (19.76), which also has a speckled dorsal surface but lacks symmetrically arranged rosette-like markings.

FRECKLE SKATE

19.76

Leucoraja lentiginosa (Bigelow & Schroeder, 1951)

DD

IDENTIFICATION. Small skate with a heart-shaped disc (width 1.2–1.3 times length), short snout with firm rostral cartilage, medium-sized eyes (orbit length 4.2–4.7% TL), rosette of ~10 orbital thorns, 4–5 nuchal thorns, triangular patch of 15–17 thorns on nape-shoulder region, stiffened tail (1.4–1.6 times precloacal length), yellowish to brownish dorsally and finely speckled with pale and dark spots. Disc anterior margin straight to moderately undulate (more so in adult males), its apex broadly rounded. Snout length 2–2.2 and interorbital space 0.6–0.7 times orbit length respectively; small lobe at its tip. Tooth rows in upper jaw 46–55. Denticles in broad band along anterior margin of disc; dorsal and caudal fins prickly, skin over eye naked; ventrally entirely smooth in juveniles, tip of snout prickly in adults. Tail tapering strongly; narrow lateral folds extend along almost entire tail; 3–5 rows of tail thorns, median row becoming reduced with growth. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about twice as high as long and separated; interdorsal space shorter than base of first dorsal fin, with 1–4 thorns; caudal-fin base about equal to first dorsal-fin base length. Pectoral-fin radials 63–68. Predorsal vertebrae 80–92.

COLOUR. Dorsal surface pale yellowish or brownish, densely speckled with very small paler yellowish and darker brown spots (not arranged in rosettes); spots on tail grouped into 5 or 6 prominent bars; spots persistent on dorsal and caudal fins. Ventral surface whitish, greyish blotches present in adults.

SIZE. Attains at least 44 cm TL. Matures at ~35–40 cm TL in both sexes, size at hatching unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Mexico, Florida (USA) to Yucatan Peninsula (Mexico). Demersal on soft bottoms of continental shelf and upper slope at 55–590 m depths. Biology poorly known.

SIMILAR SPECIES. Most similar to the Rosette Skate (19.75) in having the dorsal surface densely spotted, but the Freckle Skate's spots are not arranged in clusters.

WHITEDAPPLE SKATE

19.77

Leucoraja leucosticta (Stehmann, 1971)

DD

IDENTIFICATION. Medium-sized skate with a weakly rhombic disc (width 1.1–1.2 times length), short snout with firm rostral cartilage, large eyes (orbit length 4.7–5.5% TL), rosette of 7 orbital thorns, triangular patch of 10–30 thorns on nape-shoulder region, stiffened tail (1.2–1.3 times precloacal length), and dark brown dorsal coloration with large whitish spots. Disc anterior margin weakly undulate, its apex broadly rounded. Snout angular, length 2–2.2 and interorbital space 0.7–0.9 times orbit length respectively, its tip weakly projecting. Tooth rows in upper jaw 60–69. Upper disc completely spinulose except for bare pectoral-fin centres in mature males; skin largely smooth ventrally, but anterior disc margins prickly in adults. Tail tapering gradually; lateral folds on posterior 2/3 of tail; 3–5 rows of tail thorns, the median reduced with growth. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about half as high as long and confluent or with short interspace, an interdorsal thorn only known from 1 specimen; caudal fin ~1/3–1/2 of first dorsal-fin base length. Pectoral-fin radials 76–80. Predorsal vertebrae 98–103.

COLOUR. Upper surface dark brown, disc with numerous pale blotches and milky white spots (especially in young). Ventral surface of disc and pelvic fins largely white with broad greyish posterior margins; snout tip and anterior pelvic-fin lobe tips black; undersurface of tail white or with marbled extremity.

SIZE. Attains at least 80 cm TL. Males mature at 53–59 cm TL, female maturity and hatching sizes unknown.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Mauritania to Gabon. Demersal on continental shelf and upper slope at 70–705 m depths. No information available on habitat or biology.

SIMILAR SPECIES. Resembles the Sandy Skate (19.71), but the Whitedapple Skate lacks symmetrically arranged pairs of dark-edged creamy spots (otherwise white-spotted), and its skin is less thorny.

MALTESE SKATE

19.78

Leucoraja melitensis (Clark, 1926)

CR

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width 1.1–1.2 times length), short snout with firm rostral cartilage, medium-sized eyes (orbit length 4.3–4.6% TL), rosette of 6–8 orbital thorns, 4 nuchal thorns, small triangular patch of thorns on nape-shoulder region, stiffened tail (1.2 times precloacal length), and pale brown dorsal surface with two large ocelli-like pectoral markings and usually fainter dusky blotches. Disc anterior margin undulate, its apex broadly rounded. Snout angular, length 2.7 and interorbital space 0.6 times orbit length respectively; pronounced narrowly rounded lobe at its tip. Tooth rows in upper jaw 56–58. Upper disc almost completely spinulose or with bare patch on middle of disc; ventrally largely smooth, anterior disc margins becoming prickly in adults. Tail tapering strongly; 3–5 irregular rows of tail thorns, median row reduced with growth. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, separated by short, thornless interspace.

COLOUR. Upper surface light brown with large, marbled ocellus on central base of each pectoral fin; often additional 3–4 dark brown spots with yellow centres on outer pectoral fin and 1–2 spots on each pelvic fin; pectoral marking only slightly darker than body colour. Ventral surface white with brownish edges on distal tail and snout tip.

SIZE. Attains ~50 cm TL. Size at maturity ~40 cm TL in both sexes, size at hatching unknown.

HABITAT AND BIOLOGY. North-East Atlantic; confined to Mediterranean Sea. Demersal on sandy and muddy bottoms of outer continental shelf and upper slope at 60–800 m depths. Breeds throughout year, with reproductively active females observed mainly in spring and autumn. Females produce 10–56 egg cases annually. Feeds on small crustaceans, mainly amphipods.

SIMILAR SPECIES. Resembles the Cuckoo Skate (19.79), but has a more extended snout tip, and the pectoral markings of the Cuckoo Skate are typically larger and more prominent.

CUCKOO SKATE

19.79

Leucoraja naevus (Müller & Henle, 1841)

LC

IDENTIFICATION. Medium-sized skate with a weak rhombic to heart-shaped disc (width ~1.2 times length), short snout with firm rostral cartilage, large eyes (orbit length 5–5.4% TL), rosette of 9–13 orbital thorns, large triangular patch of 10–15 thorns on nape-shoulder region, stiffened tail (1.2–1.4 times precloacal length), and 2 very prominent marbled pectoral markings. Disc anterior margin undulate, its apex broadly rounded. Snout length 1.7–1.8 and interorbital space 0.6–0.7 times orbit length respectively; its tip projecting as short triangular lobe. Tooth rows in upper jaw 50–60. Upper disc completely spinulose, except for bare pectoral-fin centres and pelvic fins in mature males; skin largely smooth ventrally, except along anterior disc and edges of tail. Thorns in 2 median rows on trunk and joining 3–5 rows on tail, median row reduced with growth. Tail tapering strongly; lateral folds extend along almost entire tail. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins upright, about half as high as long and confluent or with short, thornless interspace; caudal fin base ~1/5–1/3 of first dorsal-fin base length. Pectoral-fin radials 73–81. Predorsal vertebrae 92–104.

COLOUR. Upper surface light grey to brownish with large, prominent ocellate pectoral markings (slightly larger than size of eye); pectoral marking a blackish blotch ornamented with small yellowish spots and vermiculations; sometimes with additional pairs of smaller eye-spots. Ventral surface white, margins on disc and posterior pelvic-fin lobes greyish.

SIZE. Attains ~81 cm TL. Size at maturity for males 50–57 cm TL, females 53–60 cm TL. Egg cases ~4–6 cm long; hatches at ~9–12 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; Norway to Senegal, including Mediterranean Sea. Demersal on sandy and coarse bottoms of the continental shelf and upper slope at 10–900 m depths. Reproduces throughout year, females produce up to 100 egg cases annually. Feeds on crustaceans and polychaetes, adults mainly on bony fishes.

SIMILAR SPECIES. Similar to the smaller Maltese Skate (19.78), but has at least 2 parallel rows of trunk thorns and smaller pectoral ocelli.

WINTER SKATE

19.80

Leucoraja ocellata (Mitchill, 1815)

EN

IDENTIFICATION. Large skate with a rhombic to heart-shaped disc (width ~1.3 times length), short snout with firm rostral cartilage, small eyes (orbit length 3.5–4.1% TL), rosette of orbital thorns becoming reduced during growth, triangular patch of thorns on nape-shoulder region increasing in size during growth, stiffened tail (1–1.2 times precloacal length), and light brown dorsal coloration with strong pattern of blackish spots (and often 1–4 larger blotches). Disc anterior margin undulate (more so in adult males), its apex broadly rounded. Snout bluntly angular in young, obtuse in adults; length 2.6–3.3 and interorbital space 1.4–1.5 times orbit length respectively; its tip weakly projecting. Tooth rows in upper jaw 44–63 in juveniles smaller than 53 cm TL, usually 90–110 in adults. Upper disc rough, covered with thorns and spinules; becoming largely bare along rostrum and mid-body in large specimens; skin largely smooth ventrally, anterior disc margins prickly in adults. Tail tapering gradually; lateral folds along almost entire tail; 5 rows of tail thorns, median row lost with growth. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about half as high as long and confluent; caudal-fin base ~1/4 of first dorsal-fin base length.

COLOUR. Upper surface pale brown, usually with dense pattern of small blackish spots; additional 1–4 larger, dark-edged, white blotches resembling eye-spots on posterior half of pectoral fins. Ventral surface white, sometimes with irregular brownish blotches at rear of pectoral fins and along tail.

SIZE. Attains at least 113 cm TL, possibly larger to 150 cm TL. Males mature at ~53–58 cm TL, females ~65–73 cm TL. Young hatch at 11–13 cm TL, egg cases 6–8 cm long.

HABITAT AND BIOLOGY. North-West Atlantic; Newfoundland (Canada) to North Carolina (USA). Demersal mainly on sandy and gravel bottoms (also mud or rock) on continental shelf and upper slope at 5–725 m depths. Reproduces throughout year, females produce 18–35 egg cases annually. Diet consists of mixed benthic invertebrates (mainly crustaceans and squids) and bony fishes.

SIMILAR SPECIES. Resembles the Little Skate (19.73), but the Winter Skate is larger and has many more tooth rows.

SAWBACK SKATE

19.81

Leucoraja pristispina Last, Stehmann & Séret, 2008

LC

IDENTIFICATION. Small skate with a weakly rhombic to heart-shaped disc (width 1.1–1.2 times length), short snout with firm rostral cartilage, small eyes (orbit length 3.4–3.9% TL), 8–12 rostral thorns (none in juveniles), rosette of 12–20 orbital thorns in adults, dense triangular patch of thorns on nape-shoulder region, stiffened tail (1–1.1 times precloacal length), and uniformly pale greyish or brownish above. Disc anterior margin undulate (double concave in adult males), its apex broadly rounded. Snout length 3.4–4 and interorbital space 1–1.2 times orbit length respectively; weak lobe at its tip. Tooth rows in upper jaw 47–55. Upper disc uniformly granular in juveniles, denticles becoming less dense in adults; ventrally smooth, but tail sometimes granular. Thorns well developed; in band along mid-disc, 3–7 rows on tail. Tail tapering gradually; lateral folds weak, along only posterior half of tail. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins about half as high as long and confluent; caudal-fin base about half of first dorsal-fin base length. Pectoral-fin radials 61–64. Predorsal vertebrae 85–91.

COLOUR. Upper surface uniformly pale grey or brownish, somewhat translucent around edge of disc and on pelvic fins. Ventral surface uniformly pale or translucent; sensory pores not dark-edged. Dorsal and caudal fins with pale bases and dark margins (less distinct in adults).

SIZE. Attains at least 40 cm TL. Males mature at ~33–35 cm TL. Young hatch at ~9 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Australia and eastern Indonesia. Demersal on upper continental slope at 200–505 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the allopatric Tigertail Skate (19.72), but has a broader snout, more tooth rows, and a rougher dorsal disc. Its ventral surface is much paler than the Challenger Skate (19.129), which also occurs in Australian seas.

YELLOWSPOTTED SKATE

19.82

Leucoraja wallacei (Hulley, 1970)

LC

IDENTIFICATION. Medium-sized skate with a rounded to heart-shaped disc (width 1.2–1.3 times length), short snout with firm rostral cartilage, small eyes (orbit length 3.6–4% TL), rosette of 7–10 orbital thorns, small triangular patch with sparse thorns on nape-shoulder region, stiffened tail (1.1–1.3 times precloacal length), and striking dorsal coloration of bright yellow spots, often forming rosettes and whorls. Disc anterior margin undulate (concave in adult males), its apex broadly rounded. Snout length 2.7–2.8 and interorbital space 0.9–1.2 times orbit length respectively, its tip projecting slightly as short lobe. Tooth rows in upper jaw 59–67. Upper disc very rough; largely smooth ventrally, anterior margins of disc prickly. Thorns in median band along central disc; usually 5 rows of tail thorns in young, median row reduced with growth. Tail tapering strongly, skin folds poorly enveloped, narrow. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins tilted, about half as high as long and separated by short interspace; caudal fin short and low.

COLOUR. Upper surface yellowish brown with bright yellow markings, often densely clustered to form symmetrical yellow and brown rosettes and whorls (sometimes greyish brown with white spots); markings cover most of disc. Ventral surface uniformly whitish.

SIZE. Attains ~96 cm TL. Males mature at 64–77 cm TL; females 73–81 cm TL off west coast, but 65–70 cm TL off southern coast of South Africa. Young hatch smaller than 16 cm TL, egg cases 7–8 cm long.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; Namibia to southern Mozambique. Demersal on soft bottoms of outer continental shelf and upper slope at 75–515 m depths. Egg cases probably laid mainly in autumn. Diet consists of crustaceans, polychaetes and bony fishes.

SIMILAR SPECIES. The Leopard Skate (19.135), which also has a very thorny dorsal disc and occurs off southern Africa, has a black-spotted coloration and differs subtly in the shape of the clasper.

YUCATAN SKATE

19.83

Leucoraja yucatanensis (Bigelow & Schroeder, 1950)

DD

IDENTIFICATION. Small skate with a heart-shaped disc (width ~1.2 times length), rather short snout with firm rostral cartilage, medium-sized eyes (orbit length ~4.9% TL), skin rough with rosette of ~6–9 orbital thorns, patch of ~2–3 thorns on nape-shoulder region, stiffened tail (~1.5 times precloacal length), and pale greyish brown dorsal coloration with small dark spots. Disc anterior margin undulate, its apex broadly rounded. Snout obtuse, length about twice and interorbital space ~0.6 times orbit length respectively, its tip barely projecting. Tooth rows in upper jaw ~46. Upper disc loosely set with prickles; posterior part of pectoral fins, upper pelvic fin and dorsal fins smooth; ventral surface smooth. Thorns in usually 2 widely spaced rows along central disc and 2–5 evenly spaced rows on tail; ~3 nuchal thorns; thornlets over much of outer disc. Tail narrow, tapering gradually; lateral folds extend along almost entire tail, but extremely narrow. Pelvic-fin anterior lobe distinctly shorter than posterior lobe. Dorsal fins strongly tilted, about half as high as long and separated by short interspace (usually with 1 thorn); caudal-fin base about 2/3 of first dorsal-fin base length.

COLOUR. Upper surface pale brownish grey, sparsely speckled with small dark spots over disc and on anterior tail; spots forming darker crossbars on posterior tail (most prominent beneath each dorsal fin). Ventral surface uniform pale yellowish.

SIZE. Attains at least 30 cm TL. Males mature at ~26 cm TL. Size at hatching unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; Yucatán (Mexico) to Nicaragua. Demersal on outer continental shelf and upper slope at 190–455 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the Freckle Skate (19.76), but the dorsal surface of the Yucatan Skate is less densely covered with small spots (dark rather than pale with dark spots) and has a smaller size at maturity (26–30 cm TL *vs.* 35–44 cm TL).

KREFFT'S SKATE

19.84

Malacoraja kreffti (Stehmann, 1978)

LC

IDENTIFICATION. Medium-sized skate with a weakly rhombic disc (width ~1.2 times length), short snout with firm rostral cartilage, medium-sized eyes (orbit length ~4.3% TL), skin on upper surface covered with denticles but without enlarged thorns (sparse patch of small rostral thorns), tail firm (~1.1 times precloacal length), and uniformly pale greyish white on both surfaces. Disc anterior margin almost straight, its apex broadly rounded. Snout length ~3.3 and interorbital space ~0.9 times orbit length respectively, its tip projecting as a small, bluntly rounded lobe. Tooth rows in upper jaw ~59. Upper surface entirely spinulose with fine, close-set dermal denticles; denticles coarse and hooked only on mid-line of body and tail; ventral surface smooth, except edges of tail prickly. Tail tapering gradually; lateral folds rather broad, particularly on posterior part of tail. Pelvic-fin anterior lobe only slightly shorter than posterior lobe. Dorsal fins about half as high as long, and confluent; caudal-fin upper lobe about half of first dorsal-fin base length. Pectoral-fin radials 68–71. Predorsal vertebrae 88–94.

COLOUR. Both surfaces of disc plain pale greyish white; snout beside rostrum almost transparent; posterior trunk, tail and prickly areas on undersurface noticeably darker. Posterior disc margins dorsally and ventrally with scattered faint greyish spots; anterior pelvic-fin lobes dorsally sometimes with dusky blotches.

SIZE. Attains ~60 cm TL. Size at maturity ~50 cm TL in both sexes. Size at hatching unknown.

HABITAT AND BIOLOGY. North-East Atlantic; Iceland to Ireland, probably south to Bay of Biscay (France). Demersal on lower continental slope at 1000–1500 m depths. Biology poorly known.

SIMILAR SPECIES. Resembles the allopatric Smooth Skate (19.86), but has a paler and more uniform dorsal surface coloration and darker ventral surface.

BRAZILIAN SOFT SKATE

19.85

Malacoraja obscura Carvalho, Gomes & Gadig, 2005

DD

IDENTIFICATION. Medium-sized skate with a broad heart-shaped disc (width 1.3 times length), moderately short snout with firm rostral cartilage, small eyes (orbit length 2.6–3.7% TL), skin uniformly covered with minute denticles but without enlarged thorns, tail firm (1.1–1.3 times precloacal length), and uniformly brownish above with slightly darker brown ventral surface. Disc thin, anterior margin straight to weakly convex, its apex broadly rounded. Snout length 3.8–5.8 and interorbital space 1.1–1.6 times orbit length respectively; tip projecting as long narrow lobe; anteriormost pectoral radials falling well short of tip. Tooth rows in upper jaw 48–76. Upper surface almost entirely densely set with fine dermal denticles, but pelvic fins smooth, and sides of tail with coarser denticles. Ventral surface largely smooth; denticles confined to tip and sides of snout, more densely set on tail; tail mid-line and tip smooth. Some small thorns near eyes and in row on nape (becoming reduced in adults); median thorns reappear on posterior trunk and extend along posterior 2/3 of tail (not reaching first dorsal fin). Tail slender, tapering gradually; lateral folds ridge-like, only on posterior half of tail. Pelvic-fin anterior lobe barely shorter than posterior lobe. Dorsal fins small, very narrow, bases joined; caudal fin minute. Pectoral-fin radials 71–73. Predorsal vertebrae 96–103.

COLOUR. Plain brown to greyish brownish above (when preserved), somewhat darker on mid-trunk, pelvic fins, tail and its tip; indistinct pattern of pale spots on disc in large specimens; denticles and thorns on tail pale. Undersurface plain dark brown; whitish only in oronasal region, near pelvic axils, and tips of anterior pelvic-fin lobes.

SIZE. Attains at least 68 cm TL; largest male still immature at 50 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; south-eastern Brazil. Demersal on continental slope at 810–1105 m depths.

SIMILAR SPECIES. Of Western Atlantic species of *Malacoraja*, the Smooth Skate (19.86) has a paler undersurface and the Prickle Skate (19.87) is largely white ventrally, becoming partly dark blotched with age (rather than uniformly dark brown).

SMOOTH SKATE

19.86

Malacoraja senta (Garman, 1885)

EN

IDENTIFICATION. Medium-sized skate with a heart-shaped disc (width 1.2–1.3 times length), moderately elongate and pointed snout with firm rostral cartilage, small eyes (orbit length 3.7–4.2% TL), skin on upper surface velvet-like, enlarged thorns anteriorly but without parallel and lateral thorn rows, tail firm (1–1.2 times precloacal length), greyish brown with obscure dark spots above, and largely white ventral surfaces. Disc anterior margin almost straight (weakly undulated in mature males), its apex broadly rounded. Snout length ~3.4–3.6 and interorbital space ~0.9–1.1 times orbit length respectively; tip projecting as very small, bluntly rounded lobe. Tooth rows in upper jaw ~38–40. Upper surface densely covered with fine denticles (except for translucent areas beside rostrum); ventral surface smooth, except anterior disc margins and tail prickly in adults. Orbital, nuchal and small shoulder thorn patches present; median row of thorns extend along trunk and tail, becoming smaller rearwards and absent from posterior half or third of tail; no parallel and lateral thorn rows. Tail tapering gradually; lateral folds very narrow, on posterior 2/3 of tail. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins small, tilted and joined; caudal-fin upper lobe about half first dorsal-fin base length.

COLOUR. Dorsal surface greyish brown, often with obscure dark spots; translucent beside rostral cartilage; two pale, dark-edged crossbars on tail of juveniles. Ventral surface of disc and pelvic fins white, or with small dusky spots; tail variable, white, blotched or uniformly dark posteriorly.

SIZE. Attains at least 71 cm TL. Males mature at 41–54 cm TL, females 49–57 cm TL. Size at hatching 8–10 cm TL.

HABITAT AND BIOLOGY. North-West Atlantic; Newfoundland to New Jersey (USA). Demersal on continental shelf and deep slope at 25–1435 m depths; most common at 70–480 m. Feeds on small crustaceans, adults also eat bony fishes.

SIMILAR SPECIES. Differs from Krefft's Skate (19.84) and the Brazilian Soft Skate (19.85) in having a median thorn row consisting of thorns that become smaller rearwards and disappear on the posterior half or third of the tail.

PRICKLE SKATE

19.87

Malacoraja spinacidermis (Barnard, 1923)

LC

IDENTIFICATION. Medium-sized skate with a broad heart-shaped disc (width 1.2–1.3 times length), moderately elongate and pointed snout with firm rostral cartilage, medium-sized eyes (orbit length 3.8–4.5% TL), skin of upper surface velvet-like, no thorns on snout and trunk, tail stiffened (~1.3 times precloacal length), plain greyish dorsally, and largely white (in juveniles) or greyish (in adults) ventrally. Disc anterior margin almost straight (weakly undulated in mature males), its apex broadly rounded. Snout length 3.2–3.9 and interorbital space 0.8–1 times orbit length respectively; tip projecting as small, bluntly rounded lobe. Tooth rows in upper jaw ~54–60. Upper surface with dense coverage of fine denticles; ventral surface smooth except for tail and prickly anterior disc margins. No thorns on snout and body posterior to shoulder girdle (except for alar and malar thorns of adult males); only juveniles have thorns beside eye, on nape, and on each shoulder. Tail tapering gradually; lateral folds narrow, only on posterior third of tail. Pelvic-fin anterior lobe only slightly shorter than posterior lobe. Dorsal fins strongly tilted, bases joined; caudal fin small. Pectoral-fin radials 71–74. Predorsal vertebrae 84–93.

COLOUR. Dorsal surface plain, pale greyish brown (in juveniles) to dark grey (in adults); semi-translucent near rostrum. Ventral surface white in young with grey speckles, becoming increasingly darker on disc and pelvic fins in adults; tail entirely dark grey.

SIZE. Attains at least 64 cm TL. Matures at ~59 cm TL in both sexes; smallest known specimen 10 cm TL. Fully developed egg cases unknown.

HABITAT AND BIOLOGY. Northern and Eastern Atlantic; Maine (USA) to Rockall Trough, and off north-western Africa, Namibia and South Africa. Demersal on continental and insular slopes at 450–1570 m depths; adults probably occurring at abyssal depths. Feeds on crustaceans (mainly shrimps) and small benthic fishes.

SIMILAR SPECIES. Differs from Krefft's Skate (19.84) and the Smooth Skate (19.86) in lacking thorns on the snout and along the trunk and tail posterior to the shoulder girdle.

WEST AFRICAN DWARF SKATE

19.88

Neoraja africana (Stehmann & Séret, 1983)

DD

IDENTIFICATION. Dwarf skate with a heart-shaped disc (1.3 times as broad as long), very short and blunt snout with short triangular process at its tip, 3–4 small preorbital thorns, 1–3 postorbital thorns, tail long and rather slender (~63% TL), and uniformly dark above and mainly white with broad dark disc margins below. Disc thin, anterior margin strongly undulated (particularly in mature male), outer and inner pectoral corners broadly rounded. Snout very short, length ~2.2 times interorbital width; eyes very large, orbit length ~1.4 times interorbital space. Tooth rows in upper jaw 45–49. Dorsal disc and tail almost entirely and densely set with coarse denticles, smooth ventrally. Single posterior nuchal thorn and 1 on each shoulder; no other thorns on disc (except for malar and alar thorns in adult males); median row of 17–28 thorns extending from pelvic-fin axils along anterior 2/3 of tail. Tail with narrow lateral folds, on posterior third of tail. Pelvic fins large with slender and pointed anterior lobe, ~2/3 length of posterior lobe; lobes separated by deep notch. Dorsal fins small, posteriorly on tail with bases joined. Pectoral-fin radials 61–63. Predorsal vertebrae 68–70.

COLOUR. Dorsal disc and tail greyish brown to blackish; disc and pelvic-fin margins often darker; tail sometimes with indistinct crossbars, dorsal fins blackish. Ventral surface of disc whitish centrally with broad dark margins; undersurface of tail dark brown, posterior third white.

SIZE. Attains at least 30 cm TL; maturity and hatching sizes unknown.

HABITAT AND BIOLOGY. Eastern Central and South-East Atlantic; Gabon and probably Western Sahara. Demersal on mid-continental slope at 900–1550 m depths. Rarely encountered by fishers or on research cruises and life history unknown.

SIMILAR SPECIES. Resembles 3 close relatives, the South African Dwarf Skate (19.92), Iberian Dwarf Skate (19.91) and Blue Dwarf Skate (19.89), which all have more distinctive crossbars on the tail.

BLUE DWARF SKATE

19.89

Neoraja caerulea (Stehmann, 1976)

LC

IDENTIFICATION. Dwarf skate with a heart-shaped disc (1.3 times as broad as long), very short and blunt snout with short filament at its tip, up to 12 small thorns on each orbital rim, tail long and rather slender (~60% TL), almost uniformly violet above, and ventral disc white below with dark margins and blotches. Disc thin, anterior margin deeply concave (particularly in mature male), outer and inner pectoral corners very broadly rounded. Snout very short, length ~2.9 times interorbital width; eyes very large, orbit length ~1.8 times interorbital space. Tooth rows in upper jaw 47–55. Dorsal disc entirely and densely set with fine denticles; smooth ventrally, except for narrow band of prickles along tail; 4–6 nuchal thorns and 1–3 on each shoulder; no further thorns on disc (except for malar and alar thorns in adult males); median row of 33–58 closely set thorns extend from shoulder along anterior 2/3 of tail. Pelvic fin large with slender and pointed anterior lobe, length ~2/3 as long as posterior lobe, both lobes separated by deep notch. Dorsal fins small, near tip of tail, bases joined. Pectoral-fin radials 62–68. Predorsal vertebrae 68–74.

COLOUR. Dorsal surface violet or bluish; tail with 6–9 distinct dark crossbars. Ventral surface usually white centrally with broad blackish brown margins and blotches (rarely almost entirely dark); tail pale.

SIZE. Attains ~35 cm TL. Males mature at 20–25 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; Scotland to Bay of Biscay (France). Demersal on upper and mid-continental slope and adjacent submarine banks at 600–1540 m depths. Feeds on small benthic invertebrates.

SIMILAR SPECIES. Resembles other species of *Neoraja*, but the Blue Dwarf Skate is the only member of the group having a vivid bluish or violet upper disc.

CAROLINA DWARF SKATE

19.90

Neoraja carolinensis McEachran & Stehmann, 1984

DD

IDENTIFICATION. Dwarf skate with a heart-shaped disc (~1.2 times as broad as long), very short and blunt snout with small flat triangular process at its tip, rosette of ~11 orbital thorns, tail long and rather slender (58–60% TL), uniform greyish brown above, and pale below with darker cloudy markings. Disc thin, anterior margin undulate; outer and inner pectoral-fin corners broadly rounded. Snout very short, length 2.9–3.2 times interorbital width; eyes very large, orbit length ~1.2 times interorbital space. Tooth rows in upper jaw 40–46. Dorsal disc almost entirely and densely set with fine denticles; smooth ventrally, except for narrow bands of prickles along tail. Thorns well-developed around orbit (5 preorbital, 2 supraorbital, 3 postorbital, 1 supra- and 1 interspiracular); irregular row of 6 thorns on nape and 2 thorns on each shoulder; median row of 75–80 closely set thorns extend from shoulder to about mid-length of tail. Pelvic fins large with slender and pointed anterior lobe, nearly as long as posterior lobe and lobes separated by deep notch. Dorsal fins small, located posteriorly on tail, bases joined. Pectoral-fin radials 62–66. Predorsal vertebrae 65–73.

COLOUR. Upper disc and tail uniformly greyish brown, tail without crossbars. Ventral surface white with faint cloudy greyish brown margins and abdomen with similar blotches; tail whitish.

SIZE. Attains at least 29 cm TL (adolescent male holotype).

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina to north-eastern Florida (USA). Demersal on mid-continental slope between 695–1010 m depth. Biology not well known.

SIMILAR SPECIES. Of similar shape to its congeners, but is the only member of the genus with dark cloudy markings on the ventral disc. The West African Dwarf Skate (19.88) also lacks obvious crossbars on tail, but its abdomen is largely uniformly white.

IBERIAN DWARF SKATE

19.91

Neoraja iberica Stehmann, Séret, Costa & Baro, 2008

LC

IDENTIFICATION. Dwarf skate with a heart-shaped disc (~1.2 times as broad as long), very short and blunt snout with short triangular process at tip, 5–7 preorbital and 2–3 postorbital thorns, tail long and rather slender (59–66% TL), greyish brown above and densely peppered with brown spots, and white below with greyish disc margins. Disc thin, anterior margin undulate, outer and inner pectoral corners broadly rounded. Snout very short, length ~3.1 times interorbital width; eyes large, orbit length ~1.8 times interorbital space. Tooth rows in upper jaw 40–52. Dorsal disc entirely and densely set with fine spinules; smooth ventrally, except for narrow bands of prickles along tail. Irregular row of 5 thorns on nape, 1 on each shoulder; median row of ~62 closely set thorns from shoulder to near first dorsal fin. Pelvic fin large with slender and pointed anterior lobe, length ~3/4 as long as posterior lobe, both lobes separated by a deep notch. Dorsal fins small, situated posteriorly on tail with bases joined. Pectoral-fin radials 60–69. Predorsal vertebrae 67–78.

COLOUR. Dorsal surface yellowish to greyish brown with dense coverage of dark brown spots; most obvious in juveniles, reduced to pair of symmetrical pale-edged brown spots in adults; tail with 7–8 dark crossbars. Ventral surface white with greyish margins, sometimes with brownish spot on centre of pectoral fins.

SIZE. Attains at least 35 cm TL. Males mature at ~28–29 cm TL; young hatch at ~6 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; off Spain. Demersal on upper continental slope at 270–785 m depths. Biology unknown.

SIMILAR SPECIES. Within the genus, only the South African Dwarf Skate (19.92) also often has dark spots on the upper disc. Despite differing markedly in morphology and colour, the Iberian Dwarf Skate has a surprisingly similar gene structure to the Blue Dwarf Skate (19.89). More research is needed to confirm that the species are distinct from each other.

SOUTH AFRICAN DWARF SKATE 19.92

Neoraja stehmanni (Hulley, 1972)

DD

IDENTIFICATION. Dwarf skate with a heart-shaped disc (1.2–1.4 times as broad as long), very short and blunt snout with small process at its tip, 1–6 preorbital and 1–4 postorbital thorns, 1 small interspiracular thorn in juveniles, tail long and rather slender (~60% TL), and usually brownish dorsally and white below with greyish disc margins. Disc thin, anterior margin concave (more so in adult males); outer and inner pectoral corners broadly rounded. Snout short, length ~2.8 times interorbital width; eyes large, orbit length ~0.8–1 times interorbital space. Tooth rows in upper jaw 38–44. Dorsal disc almost entirely and densely set with fine denticles; smooth ventrally. 1–4 nuchal thorns, 1 scapular thorn, 1 thorn on each shoulder; median row of 11–38 upright thorns from shoulder to first dorsal fin (developing with growth). Pelvic fin large with fin-like anterior lobe, length ~3/4 as long as posterior lobe; both lobes separated by deep notch. Dorsal fins small, posterior on tail, with confluent bases. Predorsal vertebrae 65–74.

COLOUR. Dorsal surface of disc brownish to greyish brown (possibly sometimes with irregular dark blotches and pale spots); tail with 6–7 dark crossbars. Ventral surface pale with dark pectoral margins and black spot on tip of snout; tail mottled and ends with dark dorsal crossbars.

SIZE. Attains ~38 cm TL (adult male holotype). Males mature at ~31–32 cm TL, females at ~30 cm TL. Smallest known specimen 15 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic; off South Africa and possibly further west. Demersal on continental shelf and slope at 100–1025 m depths. Biology unknown.

SIMILAR SPECIES. Resembles the Iberian Dwarf Skate (19.91) and Blue Dwarf Skate (19.89), in usually having dark crossbars on the tail, but the South African Dwarf Skate's upper disc is plain or with dark blotches and pale spots (rather than covered with brown spots or being bluish or violet).

SHARPSPINE SKATE

19.93

Okamejei acutispina (Ishiyama, 1958)

DD

IDENTIFICATION. Small skate with a variably rhombic disc (width ~1.2 times length), short snout with firm rostral cartilage, small eyes, 1–3 nuchal thorns, short orbital thorns, broad and flattened tail (~0.8 times precloacal length), and complex coloration consisting of reticulations and spots. Disc anterior margin weakly undulate (double concave in adult males), its apex narrowly rounded to angular. Snout length 3.3–4.2 and interorbital space 1–1.2 times orbit length respectively; its tip projecting prominently and narrowly rounded. Tooth rows in upper jaw 41–46. Dorsal disc with fine denticles along anterior margins and on rostral axis of adult males, denticles sparse in females; strong malar thorns; entirely smooth ventrally. Tail short, barely tapering anteriorly, then more markedly behind dorsal fins; lateral folds well developed; 3 median thorn rows in adult males, additional lateral rows in females. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, broadly rounded; caudal fin about half and interdorsal distance about fifth of first dorsal-fin base length respectively. Pectoral-fin radials 76–81. Predorsal vertebrae 66–73.

COLOUR. Dorsal surface pattern variable, finely mottled to coarsely reticulated; greyish or brownish and usually covered with dark mucus, palest beside rostral cartilage and along hind margins of disc; pectoral ocelli distinct; snout tip and preorbit usually blackish. Ventral surface dusky or whitish; sensory pores large, black-edged (often silvery in fresh specimens), extending over anterior disc almost to cloaca.

SIZE. Attains ~45 cm TL. Males possibly mature at ~25 cm TL; egg cases ~5 cm long, hatching at ~11 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Japan to southern China, including Taiwan. Demersal on continental shelf at 20–175 m depths. Lays egg cases in June and July. Feeds on benthic invertebrates and bony fishes.

SIMILAR SPECIES. Similar to the Browneye Skate (19.104), but its large ventral sensory pores extend more posteriorly on the disc and the Sharpspine Skate's snout is relatively longer.

ARAFURA SKATE

19.94

Okamejei arafurensis Last & Gledhill, 2008

LC

IDENTIFICATION. Small skate with a rhombic disc (width 1.2–1.3 times length), moderately elongate snout with firm rostral cartilage, small eyes, no nuchal thorns, rosette of orbital thorns, extremely slender tail (1.2–1.3 times precloacal length), and plain dorsal coloration. Disc anterior margin double concave to weakly undulate, apex narrowly rounded to angular. Snout length 3.5–4 and interorbital space 1–1.4 times orbit length respectively; its tip narrowly pointed. Tooth rows in upper jaw 34–38. Dorsal disc with fine denticles at snout tip and along anterior margins; malar patch well developed; smooth ventrally apart from snout and anterior disc margin. Tail very long, not markedly tapering beyond second dorsal fin; lateral folds weak, obscure; single row of slender thorns in adult males, 1–2 additional lateral rows on each side in females. Pelvic-fin anterior lobe slightly shorter than posterior lobe; claspers broad. Dorsal fins small, low; widely separated, caudal fin 1.3–1.9 and interdorsal distance 1.4–2.7 times first dorsal-fin base length respectively. Pectoral-fin radials 71–76. Predorsal vertebrae 68–73.

COLOUR. Dorsal surface uniformly greyish brown dorsally, palest around hind margins of disc and pelvic fins and beside rostral cartilage; dorsal and caudal fins of juveniles blackish, dusky to translucent in adults. Ventral surface white, without dark-edged sensory pores.

SIZE. Attains ~50 cm TL, males mature at ~30 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off north-western Australia. Demersal on outer continental shelf and upper slope at 180–300 m depths. Little known of its biology.

SIMILAR SPECIES. Similar to the more southerly distributed Australian Thintail Skate (19.100), but is more greyish dorsally, adult males have more robust claspers, and the young have a black (rather than a pale) caudal fin.

BLACK SAND SKATE

19.95

Okamejei boesemani (Ishihara, 1987)

DD

IDENTIFICATION. Medium-sized skate with a heart-shaped to rhombic disc (width 1.2 times length), moderate length snout with firm rostral cartilage, small eyes, usually 1–4 nuchal thorns, rosette of short orbital thorns, narrow and flattened tail (0.8–1 times precloacal length), and dorsal surface covered with clusters of fine spots. Disc anterior margin undulate to weakly concave, its apex broadly rounded to angular. Snout length 4.3–5.2 and interorbital space 1.3–1.7 times orbit length respectively; its tip prominent. Tooth rows in upper jaw 39–47. Dorsal disc with fine denticles on snout tip and dorsal fins, and along anterior margins of disc; malar thorn patch connected to alar patch; smooth ventrally apart from snout tip and anterior disc margin. Tail barely tapering, more so behind dorsal fins; lateral folds narrow; 3 thorn rows in adult males, those in dorsolateral rows well developed, an additional lateral row on each side in females. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins small, raked; caudal fin 1–1.5 times and interdorsal distance 0.6–0.8 of first dorsal-fin base length respectively. Pectoral-fin radials 76–81. Predorsal vertebrae 63–66.

COLOUR. Dorsal surface brownish, disc covered with clusters of fine dark speckles with diffuse pale centres; usually with small ring near insertion of pectoral fins; disc palest beside rostrum. Ventral surface greyish brown, whitish over gills and around cloaca; black-edged sensory pores dense on head, sparse over abdomen.

SIZE. Attains ~55 cm TL. Males smaller to 47 cm TL, adolescent at 40 cm TL; egg cases ~6 cm long.

HABITAT AND BIOLOGY. North-West Pacific; Korea to Vietnam, including Taiwan and southern Japan. Demersal on soft substrates of continental shelf at 20–175 m depths.

SIMILAR SPECIES. Very similar to the Borneo Sand Skate (19.96), but the Black Sand Skate differs in size (larger), meristics, and the shape and distribution of tail thorns.

BORNEO SAND SKATE

19.96

Okamejei cairae Last, Fahmi & Ishihara, 2010

NE

IDENTIFICATION. Small skate with a heart-shaped to rhombic disc (width 1.2–1.3 times length), moderate length snout with firm rostral cartilage, small eyes, 1–3 nuchal thorns, rosette of rudimentary orbital thorns, slender tail (0.9–1.1 times precloacal length), and faint speckled dorsal coloration. Disc anterior margin undulate to weakly concave, its apex broadly rounded. Snout length 3.5–4.7 and interorbital space 1–1.5 times orbit length respectively; its tip prominent. Tooth rows in upper jaw 40–51. Dorsal disc largely smooth, fine denticles along anterior margins of disc and also on snout tip in adult males; malar thorn patch present; ventrally, only along anterior disc margin. Tail tapering slightly; lateral folds poorly developed; 5 rudimentary thorn rows in adult males, rows and thorns better developed in females. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins small, raked, caudal fin 1.2–1.6 times first dorsal-fin base length; interdorsal distance usually long but variable, 0.9–1.8 times first dorsal-fin base length. Pectoral-fin radials 78–84. Predorsal vertebrae 68–75.

COLOUR. Dorsal surface brownish, with pale diffuse blotches and clusters of dark speckles; often indistinct pectoral ocelli consisting of dark spots present along with small ring near pectoral-fin insertions; rostrum not obviously demarcated from rest of snout. Ventral surface mainly greyish brown, paler area over snout, gills, chin, hind disc margin and around cloaca; sensory pores black-edged, not over abdomen.

SIZE. Females to at least 39 cm TL; males mature at 34–36 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; off northern Borneo, probably more widespread in South China Sea. Demersal on mid-continental shelf at ~65–150 m depths. Biology unknown; sometimes landed in quantity at local fish markets.

SIMILAR SPECIES. Very similar to the large Black Sand Skate (19.95) but differs in meristics, body proportions, and the shape and distribution of tail thorns.

NARROW SKATE

19.97

Okamejei heemstrai (McEachran & Fechhelm, 1982)

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc (width 1.2 times length), moderately elongate and acute snout with firm rostral cartilage, small eyes, 1–2 nuchal thorns and up to 9 orbital thorns, slender tail (1.1–1.3 times precloacal length), and ocellate dorsal colour pattern. Disc anterior margin strongly concave at snout, apex angular. Snout length 4–4.5 times and interorbital space ~0.9–1 of orbit length respectively. Tooth rows in upper jaw 31–35. Disc entirely lacking denticles; no evidence of malar, lumbar or scapular thorn patches in existing material but no adult males known. Tail very long, slender, not markedly tapering beyond second dorsal fin; lateral folds narrow; 3 regular rows of thorns in adolescent males, an additional lateral row on each side in females. Pelvic-fin anterior lobe much shorter than posterior lobe; claspers appear to narrow distally. Dorsal fins small, low, widely separated; caudal fin subequal to and interdorsal distance greater than first dorsal-fin base length respectively. Pectoral-fin radials 78–80. Predorsal vertebrae 76–82.

COLOUR. Dorsal surface brownish black with many regularly arranged ocellate markings; ocelli small, bicoloured, brownish spot surrounded by a yellowish ring; most obvious in young; dorsal fins dark brown. Ventral surface greyish with darker greyish brown blotches; sensory pores probably not obvious.

SIZE. Attains ~61 cm TL. Males mature at 40–42 cm TL, females ~52 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; Kenya to Mozambique. Demersal on upper continental slope at 200–500 m depths. Biology unknown.

SIMILAR SPECIES. Similar to the Ornate Skate (19.103) from the North-West Indian Ocean, but the Narrow Skate differs in coloration, meristics, absence of dermal denticles and probably thorns, and has a longer, more pointed snout.

HOLLAND SKATE

19.98

Okamejei hollandi (Jordan & Richardson, 1909)

DD

IDENTIFICATION. Small skate with a rhombic disc (width 1.2 times length), moderately elongate snout with firm rostral cartilage, rather large eyes, usually 1–5 nuchal thorns, rosette of orbital thorns, slender tail, dorsal fins well separated, and dark speckled dorsal colour pattern. Disc anterior margin double concave, strongly so in adult males; its apex angular. Snout length 3–3.8 and interorbital space 0.9–1.1 times orbit length respectively; its tip narrowly pointed. Tooth rows in upper jaw 37–46. Disc largely smooth, both sides with fine denticles on snout tip and along anterior margins of disc, and on dorsal fins; malar thorn patch well developed. Tail long (0.9–1.1 times precloacal length), not tapering; lateral folds narrow; 3 prominent thorn rows in adult males, an additional lateral row on each side in females. Pelvic-fin anterior lobe shorter than posterior lobe. Dorsal fins small, raked; postdorsal tail 2.4–2.6 times and interdorsal distance 1–1.2 times first dorsal-fin base length respectively. Pectoral-fin radials 78–84. Predorsal vertebrae 69–76.

COLOUR. Dorsal surface brownish with fine dark specks evenly distributed (rather than in clusters), and diffuse paler yellowish blotches over entire surface; pair of pale-edged brown ocelli at end of disc; rostral cartilage not strongly contrasted with side of snout. Ventral surface dark, greyish brown, whitish over gills, chin and snout; sensory pores small, black-edged, obvious at snout tip but not elsewhere.

SIZE. Females to ~45 cm TL; males smaller to ~35 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; China to Vietnam, including northern Borneo and Taiwan. Demersal on inner continental shelf at 65–85 m depths. Biology poorly known.

SIMILAR SPECIES. Very similar to the Sand Skates (19.95 and 19.96), but it has a relatively longer interdorsal distance and its black-spotted pattern extends over the entire disc (rather than being arranged in clusters).

SPINY SKATE

19.99

Okamejei kenojei (Müller & Henle, 1841)

DD

IDENTIFICATION. Medium-sized skate with a weakly rhombic to heart-shaped disc (width 1.2–1.3 times length), short snout with firm rostral cartilage, small eyes, 2–16 nuchal thorns, rosette of orbital thorns, very short and flattened tail (0.8–0.9 times precloacal length), and variable brownish coloration with distinct pectoral ocelli in young. Disc anterior margin double concave to weakly undulate, its apex broadly rounded. Snout length 3.5–4.7 and interorbital space 1–1.5 times orbit length respectively; its tip barely protruding. Tooth rows in upper jaw 44–52. Denticles mainly on upper snout, along anterior disc margins, and on dorsal fins; malar and alar thorn patches well developed, connected with denticles; ventral surface mostly entirely smooth, sometimes granular at snout tip. Tail broad based, strongly tapering; lateral folds well developed; 3 thorn rows in adult males, additional pair of lateral rows in females. Pelvic-fin anterior lobe broad, much shorter than posterior lobe. Dorsal fins small, broadly rounded; caudal fin 0.4–0.9 and interdorsal distance 0.4–0.5 of first dorsal-fin base length respectively. Predorsal vertebrae 71–74.

COLOUR. Dorsal surface usually plain dark brown in adult males, with small posterior pectoral marking; females and young mottled or reticulated, often with 2 pairs of pectoral ocelli; snout beside rostral cartilage and hind margins of disc pale. Ventral surface mainly white, snout tip and central disc dusky; sensory pores tiny, black-edged, absent over abdomen but small clusters near pelvic girdle.

SIZE. Attains ~52 cm TL. Males mature at 35–45 cm TL; egg cases ~5 cm long and young hatch at ~11 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; China to Korea, including Japan (records from Taiwan need confirmation). Demersal on soft bottoms from inner continental shelf to upper slope at 20–230 m depths, mainly 30–100 m. Diet includes benthic invertebrates and bony fishes.

SIMILAR SPECIES. Confused in the North-West Pacific with another blotched species of the genus *Dipturus*, the Polkadot Skate (19.39). The Spiny Skate has a shorter snout and lacks dark cloudy brown markings.

AUSTRALIAN THINTAIL SKATE

19.100

Okamejei leptoura Last & Gledhill, 2008

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.2 times length), moderately elongate snout with firm rostral cartilage, small eyes, no nuchal thorns, weak rosette of small orbital thorns, slender tail (1.1–1.2 times precloacal length), and plain dorsal coloration. Disc anterior margin double concave to weakly undulate, apex narrowly rounded. Snout length 3.1–3.7 and interorbital space 1.2–1.6 times orbit length respectively; its tip narrowly pointed. Tooth rows in upper jaw 30–39. Dorsal disc entirely smooth, apart from fine denticles at anterior half of snout and along anterior margins in adult males; malar patch small; smooth ventrally apart from snout tip and along anterior disc margin. Tail very long, not markedly tapering beyond second dorsal fin; lateral folds weak, obscure; single incomplete row of slender thorns in adult males, up to 1–2 additional short lateral rows on each side in females. Pelvic-fin anterior lobe much shorter than posterior lobe; claspers narrowing distally. Dorsal fins small, low, widely separated; caudal fin 1.2–1.6 and interdorsal distance 1.2–2.8 times first dorsal-fin base length respectively. Pectoral-fin radials 72–76. Predorsal vertebrae 67–77.

COLOUR. Dorsal surface usually pale yellowish, palest around hind margins of disc and pelvic fins, and beside rostral cartilage; caudal fin of juveniles white, dorsal fins black, becoming greyish brown in adults. Ventral surface white, without dark-edged sensory pores.

SIZE. Attains ~56 cm TL. Males mature at 32–46 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia. Demersal on upper continental slope at 200–735 m depths. Little known of its biology.

SIMILAR SPECIES. Similar to the more northern Arafura Skate (19.94), but is smoother and more yellowish dorsally. Adult males of the Australian Thintail Skate have more slender claspers and the young have a pale (rather than black) caudal fin.

BIGEYE SKATE

19.101

Okamejei meerdervoortii (Bleeker, 1860)

DD

IDENTIFICATION. Small skate with a heart-shaped to rhombic disc (width 1.1–1.2 times length), short snout with firm rostral cartilage, large eyes, 1–3 nuchal thorns (often forming a triangle), 5–6 orbital thorns, rather long tail (0.9–1.1 times precloacal length), dorsal fins well separated, and yellow-blotched dorsal colour pattern. Disc anterior margin double concave to undulate, its apex narrowly rounded. Snout length 2.2–4 and interorbital space 0.8–1 times orbit length respectively; its tip acute. Tooth rows in upper jaw 36–41. Dorsal disc largely smooth, fine denticles at snout tip and on dorsal fins of both sexes, along anterior dorsal margin in adult males; malar thorn patch well developed; smooth ventrally apart from snout tip. Tail broad based and tapering to tip; lateral folds narrow; 3 thorn rows in adult males, additional pair of lateral rows in large females. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, broadly rounded; caudal fin 0.8–1.6 and interdorsal distance 0.7–1.6 times first dorsal-fin base length respectively. Pectoral-fin radials 74–81. Predorsal vertebrae 63–67.

COLOUR. Dorsal surface brownish, with paler yellowish blotches and darker brown flecks; preorbit and rostral cartilage black (strongly contrasted with rest of snout); pectoral ocelli appearing as greyish spots when present. Ventral surface white, distinctive short black stripe at snout tip, hind margin of disc dusky; sensory pores black-edged, coverage sparse and not extending over abdomen.

SIZE. Attains ~38 cm TL. Smallest adult male 31 cm TL; egg cases ~3.5 cm long.

HABITAT AND BIOLOGY. North-West Pacific; China to Korea, including Japan (records from Taiwan need confirmation). Demersal on continental shelf at 30–150 m depths, primarily at ~80–90 m. Egg cases deposited in winter.

SIMILAR SPECIES. Differs from other small skates in the North-West Pacific in features of the clasper, as well as subtle differences in colour and body shape.

MENG'S SKATE

19.102

Okamejei mengae Jeong, Nakabo & Wu, 2007

DD

IDENTIFICATION. Small skate with a variably rhombic disc (width ~1.1 times length), moderately elongate snout with firm rostral cartilage, small eyes, no nuchal thorns, rosette of orbital thorns, slender tail (~0.9 times precloacal length), and finely spotted dorsal coloration. Disc anterior weakly undulate, its apex narrowly rounded. Snout length ~4.1 and interorbital space ~0.9 times orbit length respectively; its tip narrowly acute. Tooth rows in upper jaw ~42. Dorsal disc of only known specimen, a female, entirely smooth, lacking all but orbital thorns. Tail tapering gradually, more markedly behind dorsal fins; lateral folds well developed; 3 thorn rows in female. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, broadly rounded; caudal-fin base about equal to and interdorsal distance slightly more than half of first dorsal-fin base length respectively. Pectoral-fin radials ~96. Predorsal vertebrae ~73.

COLOUR. Dorsal surface pale brown, densely and entirely speckled with small dark spots. Ventral surface uniformly pale brown in preservative (probably paler when fresh); sensory pores small, sparsely distributed, black-edged.

SIZE. Attains at least 30 cm TL; presumed to be a small species but adults unknown.

HABITAT AND BIOLOGY. North-West Pacific; only off southern China. Based on a single female specimen and little known, probably benthic on soft bottoms of continental shelf.

SIMILAR SPECIES. According to the original description, Meng's Skate has a much higher pectoral-fin ray count than any of its relatives. Apart from this difference, it is very similar to, and may be a variation of, the Holland Skate (19.98).

ORNATE SKATE

19.103

Okamejei ornata Weigmann, Stehmann & Thiel, 2015

NE

IDENTIFICATION. Medium-sized skate with a rhombic disc (width 1.2–1.3 times length), short snout with firm rostral cartilage, large eyes, 2–6 nuchal thorns, 5–7 orbital thorns, long and slender tail (1–1.2 times precloacal length), and pattern of small ocellate clusters on dorsal surface. Disc anterior margin double concave, apex narrowly rounded. Snout length 2.6–3.5 and interorbital space 0.7–0.9 times orbit length respectively; its tip narrowly pointed. Tooth rows in upper jaw 37–42. Dorsal disc with fine denticles at snout tip and near outer and hind pectoral-fin margins, centrally on disc in large females; malar patch elongate; lumbar and scapular thorns present only in juveniles; ventrally, on snout tip, posterior half of rostrum and lower sides of tail. Tail very long, not markedly tapering beyond second dorsal fin; lateral folds narrow; 3 regular rows of thorns in adult males, additional ventrolateral row on each side in females. Pelvic-fin anterior lobe typically shorter than posterior lobe; claspers narrowing distally. Dorsal fins small, low, widely separated; caudal fin 0.8–1.3 and interdorsal distance 0.5–1.2 times first dorsal-fin base length respectively. Pectoral-fin radials 71–75. Predorsal vertebrae 75–83.

COLOUR. Dorsal surface yellowish, with scattered clusters of ocellated markings (often faint); clusters consisting of small dark brown blotches connected with yellowish borders; pattern most obvious in females and young males, fading during storage in alcohol; snout blackish on both surfaces. Ventral surface pale greyish brown but yellowish in outer parts, with dark, irregular blotches; sensory pores black-edged and sparsely distributed.

SIZE. Attains ~51 cm TL. Males mature at ~35 cm TL.

HABITAT AND BIOLOGY. North-West Indian Ocean; off Somalia (Socotra Islands). Demersal on upper continental slope at 375–390 m depths. Based on two collections of specimens and little known of its biology.

SIMILAR SPECIES. Similar in shape to the *Orbiraja* skates of the Indian Ocean, such as the Indian Ring Skate (19.107), but lacks their well-defined pectoral markings.

BROWNEYE SKATE

19.104

Okamejei schmidti (Ishiyama, 1958)

DD

IDENTIFICATION. Medium-sized skate with a broadly oval to heart-shaped disc (width ~1.2 times length), very short snout with firm rostral cartilage, small eyes, 1–2 nuchal thorns, rosette of orbital thorns, tail rather short, broad and flattened (length ~0.9 times precloacal length), and spotted and ocellated dorsal coloration. Disc anterior margin double concave to undulate, its apex broadly rounded. Snout length 3.5–3.9 and interorbital space 1.3–1.6 times orbit length respectively; tip short and triangular. Tooth rows in upper jaw 41–55. Disc almost smooth, denticles confined to snout tip and along anterior margins on both sides; large malar thorn patch beside and forward of eye. Tail tapering slightly, most obvious behind dorsal fins; lateral folds well developed; obvious median thorn row and usually a few lateral thorns in adult males, additional 1–2 dorsolateral rows on each side in females. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins close together, prominent, broadly rounded; caudal-fin base usually exceeding interdorsal distance and subequal to first dorsal-fin base length. Pectoral-fin radials 80–82. Predorsal vertebrae 69–73.

COLOUR. Dorsal surface yellowish brown with dense coverage of fine dark brown spots; large pectoral ocelli consisting of a cluster of dark spots (ring most distinct in fresh specimens). Ventral surface dusky white; large sensory pores prominent, black-edged, not extending beyond pelvic girdle onto cloacal region.

SIZE. Attains ~52 cm TL. Matures at ~44 cm TL; egg cases ~6 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off southern Japan. Demersal on inner continental shelf at 20–60 m depths. Biology little known.

SIMILAR SPECIES. The Sharpspine Skate (19.93) has large ventral pores on the pelvic girdle (*vs.* absent) and the snout is relatively longer (dorsal head 5.5–6 *vs.* 4–4.5 times interorbital width). The Browneye Skate was once considered to be a variant of the Spiny Skate (19.99).

SULU RING SKATE

19.105

Orbiraja jensenae (Last & Lim, 2010)

NE

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.2 times length), short snout with firm rostral cartilage, small eyes, weak orbital thorns, continuous row of median thorns on disc and tail, additional thorn rows on tail and several rows of smaller thornlets laterally, tail short (length 0.8–0.9 times precloacal length), pattern of pale spots and dark pectoral ocelli on dorsal surface, and pores on undersurface not dark. Disc anterior margin undulate; apex narrowly rounded. Snout length ~4–5 and interorbital space 1.2–1.5 times orbit length respectively; its tip extended slightly. Tooth rows in upper jaw 61–76. Both surfaces of disc with denticles along anterior margin beside spiracle and over snout; no malar or scapular thorns. Tail short, tapering to second dorsal fin; lateral folds narrow; 3 median thorn rows, thornlets in several rows. Pelvic-fin anterior lobe much shorter than posterior lobe; claspers narrowing distally. Dorsal fins small, low, separated slightly; caudal fin 0.3–0.9 and interdorsal distance 0.5–0.9 of first dorsal-fin base length respectively. Pectoral-fin radials 80–82. Predorsal vertebrae 79–85.

COLOUR. Dorsal surface mottled brown, covered with a dense pattern of small white spots and very conspicuous pair of dark circular pectoral ocelli with white edges (removed with surface mucus); marginally paler beside rostral cartilage. Ventral surface white, yellowish around outer margin of disc; sensory pores minute, greyish, not obvious.

SIZE. Attains at least 53 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; northern Borneo and Philippines. Demersal on mid-continental shelf at 110–120 m depths. Little known of its biology.

SIMILAR SPECIES. Colour pattern similar to Indian Ring Skate (19.107), but has darker pectoral ocelli and a more granular disc. Members of the genus *Orbiraja* resemble *Okamejei* skates, but differ in several aspects of their skeletons as well as having many more tooth rows.

ADEN RING SKATE

19.106

Orbiraja philipi (Lloyd, 1906)

NE

IDENTIFICATION. Small skate with a rhombic disc (width equal to length), moderately elongate snout with firm rostral cartilage, small eyes, 5 nuchal thorns, incomplete rosette of orbital thorns, tapering tail (subequal to precloacal length), dorsal surface largely plain and with prominent pectoral ocelli, and no dark pores on undersurface. Disc anterior margin undulate, apex narrowly rounded. Snout length ~5.5 and interorbital space ~1.5 times orbit length respectively; its tip extended slightly. Tooth rows in upper jaw ~80. Dorsal surface largely smooth, denticles present on snout tip; malar thorns present along rear half of anterior disc margin; no scapular thorns; ventrally, denticles all over snout, smooth elsewhere. Tail slender, tapering strongly to second dorsal fin; lateral folds poorly developed; 3 irregular rows of small thorns, dense band of smaller thornlets along its sides. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, widely separated; caudal fin ~0.7 of and interdorsal distance ~1.7 times first dorsal-fin base length respectively.

COLOUR. Dorsal surface uniformly brown apart from pectoral markings, snout distinctly paler beside rostral shaft; large, circular pectoral ocellus consisting of small paler flecks surrounded by darker central ring and paler outer ring (diameter slightly broader than eye). Ventral surface uniformly white; tail with dark mottling; sensory pores not obvious.

SIZE. Attains at least 36 cm TL (only known specimen late adolescent male has been lost); presumably matures about this size.

HABITAT AND BIOLOGY. North-West Indian Ocean; Gulf of Aden. Demersal on upper continental slope at depths of ~240 m. Nothing known of its biology.

SIMILAR SPECIES. Possibly a variation of the Indian Ring Skate (19.107). The Aden Ring Skate is thought to be smaller with a plainer disc, shorter and less prominent snout, more strongly arched mouth, fewer tail thorns, and wider interdorsal space. Specimens are needed to determine its validity.

INDIAN RING SKATE

19.107

Orbiraja powelli (Alcock, 1898)

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc (width 1.1–1.2 times length), moderately elongate snout with firm rostral cartilage, small eyes, incomplete rosette of orbital thorns, continuous row of median thorns on disc and tail, additional thorn rows on tail and several rows of smaller thornlets laterally, dense rows of thornlets on lumbar region of adults, prominent pectoral ocelli and pattern of pale spots on upper surface, and no dark pores on undersurface. Disc anterior margin undulate, most pronounced in adult males; apex narrowly rounded. Snout length 3.9–4.7 and interorbital space 1–1.6 times orbit length; apical lobe greatly extended in adult males. Tooth rows in upper jaw 71–75. Dorsal disc lacking denticles (except on anterior margin of adult males) but small thornlets prominent over abdomen; no malar or scapular thorns; smooth ventrally, apart from snout. Tail slender, not especially long, length ~0.9 times precloacal length; tapering strongly to second dorsal fin; lateral folds narrow. Pelvic-fin anterior lobe much shorter than posterior lobe; claspers bulbous distally. Dorsal fins small, low, variably separated. Caudal fin subequal to interdorsal distance and first dorsal-fin base length. Pectoral-fin radials 77–80. Predorsal vertebrae 80–86.

COLOUR. Dorsal surface dark brown, variably covered with dense pattern of irregular yellowish spots and pair of large pectoral ocelli (centre usually pale speckled surrounded by continuous darker brown and broken yellowish rings); paler yellowish brown beside rostral shaft. Ventral surface uniformly white; no dark sensory pores.

SIZE. Attains at least 53 cm TL. Males mature at ~35 cm TL; egg cases ~6 cm long.

HABITAT AND BIOLOGY. Northern Indian Ocean; Arabian Sea (India) to Bay of Bengal (Myanmar). Demersal on inner continental shelf to upper slope at 15–460 m depths. Little known of its biology.

SIMILAR SPECIES. Confused with other ocellate skates of Indo–Pacific region. Resembles the Sulu Ring Skate (19.105), but has fainter pectoral ocelli and a less granular disc.

AFRICAN SKATE

19.108

Raja africana Capapé, 1977

NE

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width ~1.3 times length), short snout with firm rostral cartilage, 1–2 preorbital thorns, 1 postorbital and thorn over spiracle, tail moderately elongate and slender (~54% TL), and faint pectoral ocelli. Disc broad, rather thick; anterior margins undulate and pectoral-fin apices narrowly rounded in females (more strongly undulate and rounded in adult males). Snout anterior angle obtuse, length ~3.3 times interorbital space; eyes large, orbit length about equal to interorbital space. Tooth rows in upper jaw 55–61. Dorsal disc largely naked, except for 2 rows of malar thornlets on anterior margins. Thorns in continuous row along mid-line of disc and tail; 1–4 nuchal thorns, 1 mid-scapular thorn and thorn on each shoulder; ~20 thorns from shoulder to first dorsal fin, and 1–3 small interdorsal thorns; lateral row of small thorns on each side of tail. Ventral disc entirely smooth. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, separated at bases. Pectoral-fin radials 80–84.

COLOUR. Upper surface of disc yellowish brown with small, inconspicuous pectoral marking; ocellus with pale centre circled by darker brownish ring, positioned on posterior base of pectoral fin. Undersurface of disc whitish with somewhat darker pectoral margins; no dark-edged pores.

SIZE. Attains at least 39 cm TL (based on female holotype); possibly up to 80 cm TL based on unconfirmed reports.

HABITAT AND BIOLOGY. Eastern Central Atlantic; off Mauritania and Tunisia, including Mediterranean Sea. Demersal on continental shelf and upper slope at 50–400 m depths. Biology unknown.

SIMILAR SPECIES. The validity of this species is considered questionable. Known largely from the holotype, a small female from Mauritania, which could be an aberrant specimen of the Brown Skate (19.115) or its relatives. Other material has never been deposited in a collection.

ATLANTIC STARRY SKATE

19.109

Raja asterias Delaroche, 1809

NT

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), moderately long snout with firm rostral cartilage, 1–3 preorbital and 1 postorbital thorn, thorn over spiracle, tail moderately long and slender (~55% TL), and upper surface covered with black spots. Disc broad, thin, anterior margin weakly undulate; outer and inner pectoral-fin corners narrowly rounded to acute. Snout anterior angle obtuse, length ~2.5 times interorbital space; eyes small, orbit length more than 1.5 in interorbital space. Tooth rows in upper jaw 36–42. Dorsal disc smooth in juveniles, very prickly in adults; row of 1–4 nuchal thorns, 1–2 thorns on each shoulder; median row of 50–70 closely spaced thorns from nape to first dorsal fin, 0–2 small interdorsal thorns; additional parallel row of thorns on tail in adults. Ventral disc smooth, except tip of snout. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, often well separated at bases. Pectoral-fin radials 70–76.

COLOUR. Upper surface yellowish brown with symmetrical blotches with light centres, more or less surrounded by irregular dark markings; those on centre of pectoral fins vaguely resembling ocelli; numerous black spots scattered on disc. Undersurface white, posterior pectoral-fin margins reddish; no dark-edged pores.

SIZE. Attains at least 76 cm TL, exceptionally to 94 cm TL. Males mature at ~52 cm TL, females ~56 cm TL. Hatching size ~8 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; largely confined to Mediterranean Sea, also off Portugal. Benthic, nearshore on continental shelf to upper slope at 1–700 m depths, mostly between 20–50 m. Feeds on benthic crustaceans and bony fishes. Produces 30–112 egg cases annually from 3–4 years of age.

SIMILAR SPECIES. Other spotted skates, the Blonde (19.110), Spotted (19.116) and Thornback (19.111) Skates, from the Mediterranean Sea have fewer than 50 thorns in a median row on the disc and tail.

BLONDE SKATE

19.110

Raja brachyura Lafont, 1873

NT

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), moderately long snout with firm rostral cartilage, tip slightly pronounced, few preorbital and postorbital thorns, tail moderately long and slender (~50% TL), and covered with dense pattern of fine dark spots. Disc broad, thin; anterior margins weakly undulate, outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length ~2 times interorbital space; eyes rather small, orbit length about half interorbital space. Tooth rows in upper jaw 60–90. Dorsal disc mostly smooth in juveniles, prickly in adults; regular median row of 40–45 thorns from nape to first dorsal fin, interrupted on back in large males; 1 interdorsal thorn; side of tail with row of strongly hooked thorns in large individuals. Ventral disc smooth. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, well separated at bases. Pectoral-fin radials 95–100. Predorsal tail vertebrae 53–58.

COLOUR. Upper surface of disc yellowish to pale greyish brown, with numerous small dark spots extending to disc edges, and several larger circular pale spots symmetrically paired on both wings, encircled by close-set dark dots. Undersurface white, posterior pectoral and pelvic margins pale greyish; no dark-edged pores.

SIZE. Attains ~120 cm TL, commonly to 100 cm TL. Males and females mature at 80–90 cm TL. Egg cases 8–12 cm long, hatch at 16–18 cm TL.

HABITAT AND BIOLOGY. North-East and Eastern Central Atlantic; Norway to Morocco, including Mediterranean Sea. Benthic on continental shelf and upper slope, mainly from nearshore to 150 m depth, but also recorded from 900 m. Feeds on benthic crustacean and bony fishes. Produces ~30 egg cases annually.

SIMILAR SPECIES. Distinguished from the other spotted *Raja* species of the North-East Atlantic, the Spotted Skate (19.116) and Thornback Skate (19.111), by its comparatively high tooth-row count.

THORNBACK SKATE

19.111

Raja clavata Linnaeus, 1758

NT

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, few preorbital and postorbital thorns, tail moderately long and slender (~50% TL), and heavily marbled colour pattern. Disc thick, anterior margin slightly undulate; outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length ~2 times interorbital space; eyes rather large, orbit length ~1.4 in interorbital space. Tooth rows in upper jaw 36–44. Dorsal disc entirely prickly in juveniles with regular median row of 30–50 prickly thorns from nape to first dorsal fin, interrupted on back in large males; 0–2 interdorsal thorns, a lateral row of strong hooked thorns along edge of tail in large individuals; strong thorny tubercles on both dorsal and ventral surfaces in large females, Ventral surface prickly in large females, thorns confined to snout in young and adult males. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, well separated at bases. Pectoral-fin radials 74–81. Predorsal tail vertebrae 49–69.

COLOUR. Pattern on upper surface of disc variable marbled, usually brownish to greyish with variegated dark and light spots and cloudy blotches. Tail light with dark crossbars. Undersurface white, posterior margins of disc and pelvic fins often greyish; no dark-edged pores.

SIZE. Attains ~130 cm TL. Males mature at 60–77 cm TL, females 60–85 cm TL. Egg cases 6–9 cm long, hatch at ~10–13 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Iceland to Madagascar, including Mediterranean Sea. Widespread, benthic on continental shelf and slope at 5–1020 m depths. Feeds on benthic crustaceans and fishes. Produces up to 150 egg cases annually; maturity age 7–8 years.

SIMILAR SPECIES. Distinguished from other spotted skates of the North-East Atlantic, the Spotted Skate (19.116) and Blonde Skate (19.110), by prominent dark crossbars on the tail, and the presence of spiny bucklers on the dorsal surface of adults (also on the ventral surface of large females). Incorrectly placed in the genus *Malacoraja* by some recent authors.

CAPE VERDE SKATE

19.112

Raja herwigi Krefft, 1965

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.2 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, 1 preorbital and 1 postorbital thorn, tail moderately long and slender (~54% TL), and heavily blotched upper surface with prominent pectoral markings. Disc thick, anterior margins weakly undulate; outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length ~3.1 times interorbital space; eyes rather large, orbit length ~1.1 in interorbital space. Tooth rows in upper jaw ~36. Dorsal disc mostly prickly with median row of ~32 thorns from nape to first dorsal fin; 0–2 interdorsal thorns; lateral row of thorns along each side of tail. Ventral surface smooth, denticles only along anterior margin of disc. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, widely separated at bases. Predorsal tail vertebrae ~46.

COLOUR. Upper surface of disc yellowish or brownish, covered with dense and almost symmetrical pattern of pale circular blotches (encircled by fine blackish spots) and solid, blotch-like pectoral markings; markings on each pectoral-fin base large (similar to eye size), dark brown with 1–3 smaller creamy central spots. Tail with 3–5 faint dark saddle-like blotches. Undersurface white, with light greyish margins; no dark-edged pores.

SIZE. Attains ~55 cm TL. Males and females mature from ~35 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; known only from off Cape Verde Islands. Benthic on continental shelf and slope mainly at 55–100 m depths, possibly to 300 m. Biology poorly known; possible bycatch of local trawl fisheries.

SIMILAR SPECIES. Distinguished from other Eastern Atlantic and Mediterranean spotted skates, e.g. the Brown (19.115), Spotted (19.116), Blonde (19.110), Thornback (19.111) and Rough (19.121) Skates, by its distinctive dorsal colour pattern and blotch-like pectoral markings.

MADEIRA SKATE

19.113

Raja maderensis Lowe, 1838

VU

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, 1–3 preorbital and 1–2 postorbital thorns, tail moderately long and slender (~50% TL), and upper disc dark with bands of small white spots. Disc thick, anterior margin weakly undulate (more so in adult males); outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length ~2.8 times interorbital space; eyes rather large, orbit length ~1.1 in interorbital space. Tooth rows in upper jaw 39–49. Dorsal disc largely prickly; 1–3 thorns on nape; median row of 21–25 thorns extending from origin of tail to first dorsal fin, sometimes extending forward slightly on trunk (by 1–6 thorns), 2–3 interdorsal thorns; lateral row of 7–12 strong thorns along each side of tail. Ventral surface almost entirely prickly in large specimens, with smooth areas in young. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, separated at bases.

COLOUR. Upper surface dark brownish with very dense pattern of pale spots, usually forming reticulations or arranged into transverse bands. Undersurface white, with greyish margins and sometimes dark blotches on snout tip, pectoral girdle and axil, anterior lobe of pelvic fin, and tail tip; no dark-edged pores.

SIZE. Attains ~80 cm TL. Males and females mature at 50–60 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; Madeira and Canary Islands, possibly also Azores Archipelago. Benthic on insular shelves to ~150 m depth. Biology poorly known.

SIMILAR SPECIES. Resembles the Thornback Skate (19.111), but its dorsal pattern is more heavily reticulated, with markings generally grouped in patches on wings to form transverse bands, and there are no regular crossbars on the tail.

SMALLEYE SKATE

19.114

Raja microocellata Montagu, 1818

NT

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.4 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, 0–2 preorbital and 0–3 postorbital thorns, tail moderately long and slender (~50% TL), and upper surface dark with distinctive pattern of paler blotches and bands arranged almost parallel to disc margins. Disc thick, anterior margin slightly undulate; outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length ~2 times interorbital space; eyes conspicuously small, orbit length ~3.5 in interorbital space. Tooth rows in upper jaw 44–52. Dorsal disc mostly prickly; 3 nuchal thorns; median row of ~50 thorns from shoulder to first dorsal fin, reducing in relative size with age, no interdorsal thorn; parallel row of small thorns on trunk (mainly in large females) and lateral row of strong thorns along sides of tail. Ventral surface mostly smooth in young, prickly in adults. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margin, close set at base. Pectoral-fin radials ~91. Predorsal tail vertebrae ~56.

COLOUR. Upper surface of disc pale brown to greyish olive with strong pattern of pale blotches and bands; bands narrow, dark-edged and mostly arranged nearly parallel to disc margins; small, pale dark-edged blotches mainly on central disc; sides of tail pale. Undersurface white, with pale greyish margins on disc and pelvic fins; no dark-edged pores.

SIZE. Attains ~103 cm TL. Males and females mature at ~58 cm TL. Hatching size 10–13 cm TL.

HABITAT AND BIOLOGY. North-East and Eastern Central Atlantic; British Isles to Morocco. Benthic, inshore on continental shelf to ~110 m depth. Biology poorly known. Feeds on small benthic crustaceans and fishes. Produces 54–61 egg cases annually.

SIMILAR SPECIES. Distinguished from the other Eastern Atlantic and Mediterranean skates by its striking dorsal colour pattern (pale bands running parallel to disc margin) and smaller eyes.

BROWN SKATE

19.115

Raja miraletus Linnaeus, 1758

LC

IDENTIFICATION. Small skate with a rhombic disc (width ~1.3 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, 2 preorbital and 2–3 postorbital thorns, tail moderately long and slender (~50% TL), and yellowish brown upper surface with prominent pectoral markings and covered with dark spots. Disc thick, anterior margin slightly undulate; outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length 3.2 times interorbital space; eyes rather small, orbit length ~1.2 in interorbital space. Tooth rows in upper jaw 36–43. Dorsal disc prickly only in young, mostly smooth in adults; 2 nuchal thorns, some thorns on shoulders and trunk in young, reducing with growth; median row of ~14–18 thorns on tail from pelvic axil to first dorsal fin, 2 interdorsal thorns; lateral row of strong thorns along each side of tail. Ventral surface smooth, snout prickly in mature males. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margin, well separated at base. Pectoral-fin radials 79–83. Predorsal tail vertebrae 51–57.

COLOUR. Upper surface of disc yellowish to reddish brown and heavily spotted with conspicuous pectoral markings; numerous dark spots scattered over disc, pelvic fins and tail; pectoral ocellus consisting of light bluish spot, encircled by dark bluish central ring and orange outer ring. Undersurface white, edges of disc slightly darker; no dark-edged pores.

SIZE. Attains ~60 cm TL. Females mature at 39–44 cm TL, males 36–40 cm TL. Hatching size ~5 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; Spain (Bay of Biscay) to Morocco and Madeira, including Mediterranean Sea. Benthic on continental shelf and upper slope from 50–555 m depths, possibly to 800 m. Feeds on small invertebrates and bony fishes. Produces 40–72 egg cases annually.

SIMILAR SPECIES. Distinguished from other Eastern Atlantic and Mediterranean skates by its striking pectoral ocellus consisting of a central bluish spot surrounded by darker bluish and orange rings.

SPOTTED SKATE

19.116

Raja montagui Fowler, 1910

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, 2–3 preorbital and 2–3 postorbital thorns, tail moderately long and slender (~51% TL), upper surface with weak pectoral markings and covered with dense pattern of rather large dark spots. Disc thick, anterior margin slightly undulate; outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse, length ~2.5 times interorbital space; eyes rather small, orbit length ~1.2 in interorbital space. Tooth rows in upper jaw 38–60. Dorsal disc in young and adults largely smooth; usually 2 nuchal thorns; median row of ~20–30 thorns from shoulder to first dorsal fin in young and ~40–50 in adults, 1–2 interdorsal thorns; lateral row of thorns along each side of tail (mainly in young and becoming smaller or obscure with growth). Ventral surface mostly smooth, apart from denticles along disc anterior margins and on gills and abdomen. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, well separated at bases. Pectoral-fin radials 84–92. Predorsal tail vertebrae 52–62.

COLOUR. Upper surface of disc greyish to yellowish brown (sometimes pinkish), covered with numerous, rather large dark spots (not extending to extreme disc margins), and usually weak pectoral markings; pectoral marking appearing as small yellowish blotch loosely surrounded by obscure ring of a few dark spots; dark spots also on tail. Undersurface white, with faint greyish disc and pelvic-fin margins; no dark-edged pores.

SIZE. Attains at least 80 cm TL. Males mature at ~40 cm TL. Egg cases ~6–8 cm long, hatch at ~8–10 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; Norway to Morocco (and Canary Islands), including Mediterranean Sea. Benthic, mainly on continental shelf at 10–150 m depths, possibly to 800 m. Feeds on small benthic crustaceans and fishes. Produces 60–70 egg cases annually.

SIMILAR SPECIES. Resembles the dark-spotted Blonde Skate (19.110), but the spotted pattern does not reach the outer margins of the upper disc and the skin is smoother in the Spotted Skate.

TWINEYE SKATE

19.117

Raja ocellifera Regan, 1906

NE

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width ~1.3 times length), rather short snout with firm rostral cartilage and its tip slightly pronounced, 2–3 preorbital and usually 2 postorbital thorns, tail long and slender (53–54% TL), and upper surface faintly spotted yellowish brown with prominent pectoral markings. Disc anterior margin weakly undulate (similar in adult males), outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle very obtuse, length 2.2–2.5 times interorbital space; eyes rather small, orbit length ~1.6 in interorbital space. Tooth rows in upper jaw 36–46. Dorsal disc smooth in adults and young. Thorns on nape 2–3, some thorns on shoulders in young, reducing with growth; median row of 20–23 thorns on tail from posterior disc to first dorsal fin, 0–2 interdorsal thorns; 2 widely spaced lateral rows of strong thorns along each side of tail in females. Ventral surface smooth, apart from snout tip. Pelvic fins moderately large, rather deeply incised. Dorsal fins low, with rounded margins, well separated at bases. Pectoral-fin radials 83–86. Predorsal tail vertebrae 46–48.

COLOUR. Upper surface medium brown, usually covered with numerous small, closely set, darker brown spots and a conspicuous pectoral marking; pectoral ocellus large, consisting of broad blue spot, encircled by narrow dark central ring and pale yellow outer ring. Undersurface white, edges of disc marginally darker; no dark-edged pores.

SIZE. Attains ~49 cm TL.

HABITAT AND BIOLOGY. South-West Indian Ocean; off South Africa. Benthic on continental shelf at 15–105 m depths, possibly deeper. Feeds on small benthic crustaceans and bony fishes.

SIMILAR SPECIES. Distinguished from most other members of the genus *Raja* in the Eastern Atlantic and Mediterranean Sea by its strikingly colourful pectoral ocelli. The Brown Skate (19.115) and African Brown Skate (19.118) have very similar ocelli but differ subtly in meristics and body shape.

AFRICAN BROWN SKATE

19.118

Raja parva Last & Séret, 2016

NE

IDENTIFICATION. Small to medium-sized skate with a rhombic disc (width ~1.1 times length), moderately long snout with firm rostral cartilage and its tip slightly pronounced, 3–5 preorbital and usually 3 postorbital thorns, tail long and slender (~55% TL) with widely spaced dorsal fins, and upper surface plain yellowish brown with prominent pectoral markings. Disc thick, anterior margin weakly undulate (even in adult males); outer and inner pectoral-fin corners narrowly rounded. Snout anterior angle obtuse, length 2.8–3 times interorbital space; eyes rather large, orbit length 0.8–0.9 times interorbital space. Tooth rows in upper jaw 34–50. Dorsal disc prickly only in young, mostly smooth in adults. Thorns on nape 2–3, large malar patch beside eyes in adult males; thorn present on shoulders in young, often absent in adults; tail with median row of thorns extending from near pelvic axil to first dorsal fin, and additional 1–2 lateral rows of strong thorns along each side; 2–3 interdorsal thorns. Ventral surface smooth, snout prickly in mature males. Pelvic fins moderately large, not very deeply incised. Dorsal fins small with narrowly rounded margins, bases very widely separated. Pectoral-fin radials 79–89. Predorsal tail vertebrae 45–54.

COLOUR. Upper surface of disc yellowish to brownish and plain (occasionally faintly spotted) with large and conspicuous pectoral markings; pectoral ocellus large, consisting of rather large blue spot, encircled by dark bluish black central ring and yellowish outer ring. Undersurface white, edges of disc marginally darker; no dark-edged pores.

SIZE. Attains at least 63 cm TL. Males mature from ~37 cm TL. Hatching size ~9 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Mauritania to Namibia. Benthic on African continental shelf and upper slope at 10–300 m depths, mainly occurs inshore. Biology unknown.

SIMILAR SPECIES. Belongs to recently recognised species complex that includes the Brown Skate (19.115) and the Twineye Skate (19.117). Their distributions appear not to overlap. The African Brown Skate has larger eyes and more widely spaced dorsal fins than its relatives.

PITA SKATE

19.119

Raja pita Fricke & Al-Hassan, 1995

DD

IDENTIFICATION. Small to medium-sized skate with a rhombic disc (width ~1.2 times length), short snout with firm rostral cartilage, row of thorns extending along mid-line of disc, short scapular rows and incomplete rosette of orbital thorns, broad tapering tail (length equal to precloacal length), and upper surface covered with dark blotches. Disc anterior margin undulate; apex narrowly angular. Snout short, length ~2.8 and interorbital space subequal to orbit length respectively; its tip only slightly extended; eyes rather large, interspiracular distance ~7% TL. Tooth rows in upper jaw ~48. Dorsal disc mostly well covered with granular denticles, densest at snout tip and along anterior disc margin beside spiracles; 3 scapular thorns in a row on each side; ventral surface smoother, denticles confined to snout mid-line, anterior margin of disc, and small patches around cloaca. Tail short with a thick base, tapering strongly to second dorsal fin; lateral fold slender; covered with regular median row and 6 more laterally positioned irregular rows of similar thorns. Pelvic-fin anterior lobe much shorter than posterior lobe. Dorsal fins small, close together, interdorsal distance and caudal fin much shorter than first dorsal-fin base length. Pectoral-fin radials ~75. Predorsal vertebrae ~86.

COLOUR. Dorsal surface of disc and pelvic fins pale brown, covered with irregular dark brown blotches and streaks; tail, and dorsal and caudal fins, darker brown. Ventral surface pale brown; few bright sensory pores on snout.

SIZE. Attains at least 47 cm TL. Maturity stage of only recorded specimen unknown; presumably a small to medium-sized species.

HABITAT AND BIOLOGY. North-West Indian Ocean; possibly endemic to Persian Gulf. Demersal on muddy bottoms in shallow water; single known specimen collected at ~15 m depth. Nothing known of its biology, but occurs in coolest part of Gulf.

SIMILAR SPECIES. Superficially similar to the Leopard Skate (19.135), but is smaller and has a brighter undersurface. Temporarily placed in *Raja* but may belong to another genus (probably to *Leucoraja* or *Rajella*).

SPECKLE SKATE

19.120

Raja polystigma Regan, 1923

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.3 times length), snout short with firm rostral cartilage and its tip slightly pronounced, small preorbital and 1–2 postorbital thorns, tail moderately long and slender (~53% TL), and finely and densely spotted upper disc with small pectoral markings. Disc thin, anterior margin weakly undulate (more so in adult males); outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle obtuse; length ~2 times interorbital space; eyes rather small, orbit length ~2.1 in interorbital space. Tooth rows in upper jaw 50–60. Dorsal disc largely smooth, denticles confined to snout, anterior disc margins and back; single nuchal and shoulder thorns; median row of ~22–28 thorns on tail from pectoral axil to first dorsal fin, 1 interdorsal thorn; lateral row of small thorns usually along each side of tail. Ventral surface mostly smooth, spinulose on snout and anterior disc margin. Pelvic fins moderately large, not very deeply incised. Dorsal fins small with rounded margins, well separated at bases.

COLOUR. Upper surface of disc greyish to greenish brown; numerous dark spots and often indistinct pale spots scattered over disc and pelvic fins; small pectoral marking consisting of irregular pseudo-ocellus with dark ring surrounded either side by pale edges. Undersurface white, disc margins greyish; no dark-edged pores.

SIZE. Attains ~71 cm TL. Males mature at ~53 cm TL, females ~63 cm TL. Egg cases ~5–6 cm long.

HABITAT AND BIOLOGY. North-East Atlantic; endemic to the Mediterranean Sea, mostly in southern part of western basin. Benthic on continental shelf and slope at 10–635 m depths, possibly to 800 m. Biology poorly known. Feeds on small benthic crustaceans and fishes. Produces 20–62 egg cases annually.

SIMILAR SPECIES. Distinguished from other spotted skates of the Mediterranean Sea having pectoral markings, by its shorter snout, strongly flattened and mostly smooth disc, and the appearance of its ocelli.

ROUGH SKATE

19.121

Raja radula Delaroche, 1809

EN

IDENTIFICATION. Medium-sized skate with a weak rhombic to somewhat rounded disc (width ~1.2 times length), snout short with firm rostral cartilage and its tip barely pronounced, small orbital thorns, tail moderately long and slender (~53% TL), and greyish above with dense pattern of paler spots, darker lines and weak pectoral markings. Disc thick, anterior margin weakly undulate (even in adult males); outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle very obtuse, length ~2.3 times interorbital space; eyes small, orbit length ~1.5 in interorbital space. Tooth rows in upper jaw 36–43. Dorsal disc entirely prickly; 3–4 small nuchal thorns; median row of ~22–28 thorns on trunk and tail, row interrupted or thorns reduced and more widely spaced on trunk in adults, usually 2 interdorsal thorns; lateral row of small thorns along each side of tail. Ventral surface with denticles on snout and distal tail in young and mature males, also prickly around mouth, abdomen and proximal tail in females. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, well separated at bases.

COLOUR. Upper surface of disc variable, greyish to reddish brown with numerous white spots and dark transverse or oblique lines on disc and pelvic fins; pectoral ocellus small, with dark centre encircled by yellowish inner ring and dark outer ring (dark centre sometimes with light spots). Undersurface white, disc margins greyish; no dark-edged pores.

SIZE. Attains ~70 cm TL. Males mature at ~40–47 cm TL, females ~46–56 cm TL. Egg cases ~5–6 cm long.

HABITAT AND BIOLOGY. North-East Atlantic; Mediterranean Sea (mostly western sector), possibly also Portugal and Morocco. Benthic on continental shelf and slope to a depth of ~350 m. Biology poorly known. Feeds on benthic invertebrates and fishes.

SIMILAR SPECIES. Distinguished from other Mediterranean spotted skates with ocellated pectoral markings by its shorter and broader snout, entirely prickly disc (mostly smooth in the Speckle Skate, 19.120) and colour pattern.

BISCUIT SKATE

19.122

Raja straeleni Poll, 1951

DD

IDENTIFICATION. Medium to large skate with a rhombic disc (width 1.2–1.4 times length), snout moderately long with firm rostral cartilage and its tip pronounced, very small orbital thorns, tail moderately long and slender (51–58% TL), and upper surface black-spotted with dark-edged blotches and lines. Disc thick, anterior margin weakly undulate (stronger in males); outer and inner pectoral-fin corners narrowly to acutely rounded. Snout anterior angle moderately obtuse, length ~2 times interorbital space; eyes rather large, orbit length ~1.4 in interorbital space. Tooth rows in upper jaw 33–41. Dorsal disc usually prickly; small nuchal and shoulder thorns sometimes present; median row of thorns extending along trunk and tail in males, additional lateral row in females, 0–2 interdorsal thorns. Ventral surface mostly smooth, except anterior disc margins in adults. Pelvic fins rather large, not very deeply incised. Dorsal fins with rounded margins, well separated at bases; long precaudal length. Pectoral-fin radials 73–81. Predorsal tail vertebrae 46–55.

COLOUR. Upper surface of disc greenish or greyish brown, with numerous pale circular blotches and darker greyish bands encircled with small dark spots and flecks; pattern more or less symmetrically arranged (sometimes with dark pectoral markings), dark spots not reaching disc margins. Undersurface whitish, sooty grey along disc margins; often with dark blotches on belly and around cloaca; tail marbled with dark blotches, sometimes entirely dark; no dark-edged pores.

SIZE. Attains ~91 cm TL. Males mature at ~56–68 cm TL, females ~55–71 cm TL. Smallest known specimen ~17 cm TL. Egg cases ~8 cm long.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Mauritania to South Africa, possibly Madagascar and Mauritius. Benthic, inshore on continental and insular shelves and slopes at 1–690 m depths. Biology poorly known. Feeds on benthic invertebrates and fishes.

SIMILAR SPECIES. Resembles other spotted members of the genus *Raja* from the Eastern Atlantic, e.g. the Thornback (19.111), Madeira (19.113) and Blonde (19.110) Skates, but can be distinguished by its characteristic variegate dorsal colour pattern.

UNDULATE SKATE

19.123

Raja undulata Lacepède, 1802

EN

IDENTIFICATION. Medium-sized skate with a weak rhombic disc (width ~1.2 times length), snout short with firm rostral cartilage and its tip barely produced, 0–2 preorbital and 0–2 postorbital thorns, tail rather short and slender (~48% TL), and dorsal surface with dark narrow bars with white-spotted edges. Disc thin, anterior margin weakly undulate; outer and inner pectoral-fin corners broadly rounded. Snout anterior angle rather obtuse, length ~2.3 times interorbital space; eyes rather small, orbit length ~2.2 in interorbital space. Tooth rows in upper jaw 40–50. Dorsal disc mostly prickly, with some smooth areas on pectoral fins, 2–8 nuchal thorns and 0–3 thorns on each shoulder; median row of 20–55 thorns on trunk and tail (row less regular in adults), 0–2 interdorsal thorns; parallel and lateral rows of small thorns sometimes in large females. Ventral surface mostly smooth, except along anterior disc margins in adults. Pelvic fins moderately large, not very deeply incised. Dorsal fins with rounded margins, well separated at bases. Pectoral-fin radials 87–89. Predorsal tail vertebrae 45–51.

COLOUR. Upper surface of disc greyish to greenish brown, with distinctive pattern of undulate dark bars, edged with white spots (resembling pearl-strings); bars almost symmetrically arranged and largely transverse. Undersurface whitish, with greyish margins; no dark-edged pores.

SIZE. Attains ~114 cm TL, possibly to 120 cm. Males mature at 71–78 cm TL, females 75–84 cm TL. Egg cases ~5–9 cm long and hatch at ~14 cm TL.

HABITAT AND BIOLOGY. North-East Atlantic; British Isles to Senegal (and Canary Islands), including Mediterranean Sea. Benthic on continental shelf to 200 m depth, mostly shallower than 100 m. Biology poorly known. Feeds on benthic invertebrates and fishes. Produces ~30 egg cases annually.

SIMILAR SPECIES. In the Eastern Atlantic, only the Smalleye Skate (19.114) also has a pattern of wavy bands on the disc, but these are lighter than on the Undulate Skate and positioned almost parallel to the disc margins.

INDONESIAN SKATE

19.124

Rajella annandalei (Weber, 1913)

DD

IDENTIFICATION. Small skate with a broadly oval disc (width ~1.2 times length), snout short with firm rostral cartilage, 3–4 small rostral thorns, triangular patch of thorns on nape and shoulder, large-based thorns on tail with sharp and strongly curved tips, tail moderately long and slender (~58% TL), and upper surface plain brownish. Disc thin, anterior margins evenly convex; outer and inner pectoral-fin corners broadly rounded. Snout anterior angle obtuse (111–130°), tip short and triangular; length 2.1–2.6 times interorbital width; eyes rather large, orbit length about equal to interorbital width. Tooth rows in upper jaw 38–46. Dorsal disc mostly prickly. Thorns in triangular patch (~8) on nape and shoulders; orbital thorns well developed, 3 preorbital thorns, 1–3 interorbital and postorbital thorns, 1–2 interspiracular thorns; median row of 25–28 thorns on trunk and tail; 2 parallel rows of large, closely spaced thorns on posterior trunk and tail (often larger than those of median row and tilted sideways); no interdorsal thorns. Ventral surface smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, separated at bases. Pectoral-fin radials 65–76.

COLOUR. Upper surface of disc plain light brown. Undersurface brownish, darker than dorsal surface.

SIZE. Attains at least 33 cm TL.

HABITAT AND BIOLOGY. Western Pacific; off Eastern Indonesia. Benthic on continental slope at 400–830 m depths. Biology unknown.

SIMILAR SPECIES. Rarely encountered species, known from only a few individuals. Distinguishable from other skates of the Western Pacific by its heart-shaped disc, fine prickly skin and plain coloration. The Challenger Skate (19.129) from temperate Australia has a distinctly heart-shaped disc with more undulate anterior margins, smaller tail thorns, and the dorsal fins are positioned closer together and nearer the tail tip.

BIGTHORN SKATE

19.125

Rajella barnardi (Norman, 1935)

LC

IDENTIFICATION. Medium-sized skate with a heart-shaped disc (width ~1.1–1.2 times length), snout short with firm rostral cartilage and its tip pronounced, 2–15 small thorns on snout and rostrum, orbital thorns few in young (forming rosette in adults), triangular patch of thorns on nape and shoulder, tail moderately long and slender (~55% TL), and disc dark above and undersurface uniformly dark or with broad dark margins. Disc thick, anterior margins undulate; outer and inner pectoral-fin corners broadly rounded. Snout anterior angle moderately obtuse (90–120°), length ~2.9–3.8 times interorbital width; eyes large, orbit length ~1.2–1.3 times interorbital width. Tooth rows in upper jaw 32–50. Dorsal disc mostly smooth, spinulose on anterior margins; triangular thorn patch developing with growth; median row of 18–24 thorns on trunk and tail (reducing in adults), no interdorsal thorns, few parallel rows of thorns in young, increasing in number (35–40) and in size with growth, becoming larger than those of the median row. Ventral surface mostly smooth, except along anterior disc margins. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, usually confluent at bases. Pectoral-fin radials 56–77. Predorsal tail vertebrae 52–65.

COLOUR. Upper surface of disc plain dusky brown, predominantly dark. Undersurface variable, from whitish with broad dark margins and dark blotches, to almost uniformly dark with areas only around nostrils and gills pale; undersurface of tail white or variably dark.

SIZE. Attains at least 75 cm TL. Males mature at ~60–62, females ~59–65 cm TL. Egg cases ~5.5 cm long and hatch at ~11 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Canary Islands to South Africa. Benthic on continental shelf and slope at ~100–1700 m depth. Biology poorly known. Feeds on small benthic crustaceans and worms.

SIMILAR SPECIES. In the Eastern Atlantic, resembles the Leopard Skate (19.135), but the Bigthorn Skate can be distinguished by its thicker disc, plain dark dorsal coloration, and strong, pale thorns.

DEEPWATER SKATE

19.126

Rajella bathyphila (Holt & Byrne, 1908)

LC

IDENTIFICATION. Medium-sized skate with a heart-shaped (in young) to rhombic disc in adults (width ~1.2 times length), snout short with firm rostral cartilage and its tip pronounced, no rostral thorns, orbital thorns not forming rosette (usually preorbit 1, postorbit 1), sparse thorns on nape and shoulder (no pronounced triangular patch), tail slender (48–61% TL), and both surfaces largely plain coloured and variable. Disc thin, anterior margins undulate; outer and inner pectoral-fin corners broadly rounded in young, acutely rounded in adults. Snout anterior angle moderately obtuse (94–106°), length ~2.8–3.3 times interorbital width; eyes rather large, orbit length subequal to interorbital width. Tooth rows in upper jaw 34–50. Dorsal disc entirely and densely prickly, pectoral-fin centres becoming smooth with growth. Thorns on nape 2–3, 1–3 on each shoulder; median row on trunk and tail 31–41 (reduced in large adults); parallel row of 10–30 small, hooked thornlets on tail in large individuals, no interdorsal thorns. Ventral surface mostly smooth, except along anterior disc margins. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials 65–78. Predorsal tail vertebrae 65–74.

COLOUR. Upper surface of disc dark, plain greyish brown in young, more brownish in adolescents, and usually greyish white in adults. Undersurface mostly dark brown with white markings on head and mid-body in young, predominantly white with dark margins in adolescents, and entirely white in adults; tail and claspers dark in adult males.

SIZE. Attains at least 95 cm TL. Matures at 65–75 cm TL. Hatching size ~12 cm TL.

HABITAT AND BIOLOGY. North Atlantic; north-eastern USA to Rockall Trough (British Isles), including mid-Atlantic Ridge (possibly south to north-western Africa). Benthic on continental and insular slopes and abyssal plain at 600–2300 m depths. Biology unknown.

SIMILAR SPECIES. Adults resemble the MidAtlantic Skate (19.134) in appearance, but the latter is uniformly white on both surfaces. Juvenile Bigelow's Skates (19.127) are similar in body shape but are dark on both surfaces.

BIGELOW'S SKATE

19.127

Rajella bigelowi (Stehmann, 1978)

LC

IDENTIFICATION. Medium-sized skate with a heart-shaped disc (width ~1.1 times length), snout short with firm rostral cartilage and its tip pronounced, rostral thorns present, rosette of 2–7 orbital thorns in adults, triangular patch of thorns on nape and shoulder, slender tail longer than body in young (~60% TL) and as long as body in adults, and ventral disc darker than upper surface. Disc thin, anterior margins undulate; outer and inner pectoral-fin corners broadly rounded. Snout anterior angle obtuse (106–130°), length ~3 times interorbital width; eyes rather large, orbit length 1–1.6 times interorbital width. Tooth rows in upper jaw 34–44. Dorsal disc entirely and densely prickly, pectoral-fin centres smooth in mature males; 2 thorns on nape and 2–3 thorns on each shoulder develop into triangular patch of 10–20 thorns in adults. Tail with median row of 26–33 thorns (becoming smaller posteriorly); 1–2 irregular parallel rows of up to 30 large, hooked thorns, extending on trunk in large individuals; no interdorsal thorns. Ventral surface smooth, except for tail edges. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials 58–71. Predorsal tail vertebrae 64–71.

COLOUR. Upper surface with plain, dark central disc and tail; outer pectoral and pelvic fins somewhat lighter, dark brown in young and greyish in adults. Ventral surface uniformly dark, darker than the dorsal surface; undersurface of tail paler.

SIZE. Attains ~55 cm TL. Matures at ~43 cm TL; hatching size ~12 cm TL.

HABITAT AND BIOLOGY. North Atlantic; North Carolina (USA) to Guinea, including mid-Atlantic Ridge. Benthic on continental and insular slopes at 625–2200 m depths; possibly also widespread on abyssal plain to 4155 m depths. Biology poorly known. Feeds on small benthic crustaceans.

SIMILAR SPECIES. Resembles the juvenile Deepwater Skate (19.126), but the latter grows larger, has fewer thorns, and the ventral disc has broad dark margins (*vs.* uniformly dark).

MUNCHKIN SKATE

19.128

Rajella caudaspinosa (von Bonde & Swart, 1923)

NT

IDENTIFICATION. Medium-sized skate with a heart-shaped disc (width 1.2–1.4 times length), snout very short with firm rostral cartilage and small triangular tip, few rostral thorns, rosette of 5–9 orbital thorns, small triangular patch of thorns on nape and shoulder, tail longer than body and thick (59–63% TL), and disc pale and slightly darker above than below. Disc thick, anterior margins undulate; outer and inner pectoral-fin corners broadly rounded. Snout anterior angle obtuse (125–130°), length 2–2.6 times interorbital width; eyes large and close-set, orbit length 1.1–1.4 times interorbital width. Tooth rows in upper jaw 32–36. Dorsal disc very prickly and rough, dense band of large thorns and smaller thornlets extend along trunk and tail; 4–5 thorns on nape, 3–4 on each shoulder. Tail with median row of 22–33 large-based thorns, smallest near rear of tail; median thorns flanked by irregular parallel row on trunk and 2 rows on each side on tail; no interdorsal thorns; strong thornlets along anterior margins of disc. Ventral surface smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Predorsal tail vertebrae 66–73.

COLOUR. Upper surface of disc uniform light greyish to brownish, with or without scattered darker spots; young usually with white-barred pattern. Ventral surface white.

SIZE. Attains ~65 cm TL. Males mature at ~53–60 cm TL, females ~50–57 cm TL. Hatches at ~10 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; Namibia and South Africa. Benthic on outer continental shelf and upper slope at 100–1100 m depth. Biology unknown.

SIMILAR SPECIES. Distinguishable from other South African *Rajella* skates by its heart-shaped disc, very short snout, relatively long tail, and a very spiny band of strong and delicate thorns on the trunk and tail.

CHALLENGER SKATE

19.129

Rajella challengeri Last & Stehmann, 2008

LC

IDENTIFICATION. Medium-sized skate with a subcircular to heart-shaped disc (width ~1.1 times length), snout short with firm rostral cartilage and its tip pronounced in mature males, few rostral thorns, 5 orbital thorns in young (more in adults), triangular patch of thorns on nape and shoulder, undersurface of disc darker than upper surface, and tail oval and tapering, and longer than body (53–56% TL). Disc rather thick, subcircular with anterior margins straight to weakly undulate in young and females (heart-shaped and deeply undulate in mature males); outer and inner pectoral-fin corners broadly rounded. Snout anterior angle moderately acute (89–99°), length 2.9–3.3 times interorbital width; eyes moderately large, orbit length 1–1.3 times interorbital width. Tooth rows in upper jaw 26–36. Dorsal disc prickly in young, smooth in adults; single row of thorns on tail in young, 3–5 rows in adults; no interdorsal thorns. Ventral surface smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, usually connected at bases. Pectoral-fin radials 57–61. Predorsal tail vertebrae 63–72.

COLOUR. Upper surface of disc plain whitish to pale grey, margins of disc slightly darker. Ventral surface almost entirely dark brown or black, often with pale areas around mouth, cloaca, and pelvic anterior lobe; tail also mostly dark.

SIZE. Attains ~56 cm TL. Males mature at ~50–52 cm TL.

HABITAT AND BIOLOGY. South-West Pacific and South-East Indian Ocean; New South Wales to Great Australian Bight (Australia). Benthic on continental slope at 860–1500 m depths. Biology poorly known.

SIMILAR SPECIES. The only *Rajella* skate in the Australian region. Distinguished from other regional skates of this family by its heart-shaped disc, elongate and oval tail, and a very pale dorsal surface contrasted with a dark ventral surface.

GHOST SKATE

19.130

Rajella dissimilis (Hulley, 1970)

LC

IDENTIFICATION. Medium-sized skate with a heart-shaped to rhombic disc (width ~1.2 times length), snout moderately long with firm rostral cartilage and its tip pronounced, few small rostral thorns, rosette of orbital thorns, triangular patch of thorns on nape and shoulder, tail about as long as body and slender, and disc pale or dark on upper surface and white centrally beneath. Disc rather thin, heart-shaped in young, more angular in adults; anterior margins undulate, outer and inner pectoral-fin corners rounded. Snout anterior angle moderately acute (88–93°), length 4.1–4.6 times interorbital width; eyes rather large, orbit length 1.1–1.3 times interorbital width. Tooth rows in upper jaw 33–41. Dorsal disc prickly; triangular patch with ~16 thorns; median row of 20–32 thorns on trunk and tail, reduced or interrupted with growth; parallel rows of 50–60 thorns on tail in young, extending onto trunk in large individuals; no interdorsal thorns. Ventral surface smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Predorsal tail vertebrae 65–69.

COLOUR. Upper surface of disc plain dark greyish brown in juveniles, becoming paler in adults. Ventral surface white with broad dark margins, undersurface of tail mottled with white tip.

SIZE. Attains ~82 cm TL. Males mature at 52–65 cm TL, females 54–61 cm TL. Hatches at ~13 cm TL, egg cases ~8 cm long.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Rockall Trough (British Isles) to South Africa. Benthic on continental slope at 400–1640 m depths. Biology poorly known. Feeds on benthic crustaceans and bony fishes.

SIMILAR SPECIES. Distinct from other *Rajella* species of the Eastern Atlantic and Western Indian Ocean by the largely smooth dorsal surface of the disc in large males, and a white undersurface with broad dark margins and a mottled tail.

GALAPAGOS SKATE

19.131

Rajella eisenhardti Long & McCosker, 1999

DD

IDENTIFICATION. Medium-sized skate with heart-shaped disc (width ~1.1 times length), snout very short with firm rostral cartilage and its tip pronounced, few thorns on rostrum, 5–6 orbital thorns (preorbit 1–2, mid-orbit 1, postorbit 3), triangular patch of thorns on nape and shoulder, tail longer than body and slender (52–56% TL), and disc darker underneath than above. Disc rather thin, anterior margin weakly undulate; outer and inner pectoral-fin corners rounded. Snout anterior angle moderately acute, length ~3.5–3.6 times interorbital width; eyes rather large, orbit length about equal to interorbital width. Tooth rows in upper jaw 46–48. Dorsal surface entirely prickly (including tail); 5 nuchal thorns, 3 thorns on each shoulder; median row of 6–7 thorns on trunk, and ~23–24 on tail; 1 parallel row of 19–39 smaller thorns on each side of tail; no interdorsal thorns. Ventral surface smooth, lower edges of tail prickly. Pelvic fins moderately large, deeply incised. Small dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials 68–69. Predorsal tail vertebrae 67–68.

COLOUR. Upper surface of disc purplish grey or brownish grey, with whitish blotch on pectoral-fin margin. Ventral surface darker, distinct white areas on snout tip, around mouth, nostrils, gill slits and cloaca, and tips of anterior pelvic-fin lobes and tail. Large thorns whitish.

SIZE. Attains at least 39 cm TL (known only from 2 juveniles).

HABITAT AND BIOLOGY. Eastern Central Pacific; Galapagos Islands. Benthic on insular slopes at 750–905 m depths. Biology unknown.

SIMILAR SPECIES. Resembles the Blackish Skate (19.137) from Chile, which has a shorter snout, brown ventral disc with paler cloudy areas, smooth median stripe on undersurface of tail, and 3 median rows of thorns originating well forward near the shoulders (rather than over the pelvic fins).

SOOTY SKATE

19.132

Rajella fuliginea (Bigelow & Schroeder, 1954)

LC

IDENTIFICATION. Small skate with a weak rhombic disc (width ~1.1 times length), short snout with firm rostral cartilage, small eyes (orbit length ~3.9% TL), few small rostral thorns, rosette of ~4 orbital thorns, small triangular patch of thorns on nape and shoulder, long and stiffened tail (~61% TL), and uniform dark greyish dorsal coloration. Disc anterior margin weakly undulate, its apex broadly rounded. Snout length ~2.5 and interorbital space ~0.9 times orbit length respectively; its tip weakly projecting. Tooth rows in upper jaw ~41. Upper disc almost entirely and densely set with denticles, skin on only posterior pectoral fins smooth and without denticles. Ventral surface largely smooth, tail densely set with prickles except for very narrow naked median strip. Tail tapering gradually; lateral folds very narrow and only on posterior 40% of tail; 3–4 irregular rows of tail thorns. Pelvic-fin anterior lobe only marginally shorter than posterior lobe. Dorsal fins about half as high as long and confluent at bases; caudal-fin base about half length of first dorsal-fin base.

COLOUR. Upper surface uniform dark greyish. Ventral surface dark greyish brown to black, distinctly darker than dorsal surface on head and outer disc.

SIZE. Attains at least 45 cm TL. Males mature at ~42 cm TL. Egg cases ~13 cm long; size at hatching unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Mexico (USA), Lesser Antilles, Colombia and Venezuela. Demersal on insular slopes at 730–1280 m depth. Biology poorly known.

SIMILAR SPECIES. Resembles the Deepwater Skate (19.126), but has a more obtuse anterior contour of the disc and the ventral tail is prickly (rather than smooth).

ROUND SKATE

19.133

Rajella fyllae (Lütken, 1887)

LC

IDENTIFICATION. Medium-sized skate with a roundish, heart-shaped disc (width ~1.3 times length), snout very short with firm rostral cartilage, and a small triangular tip, separate orbital thorns in young, rosette of 5–9 orbital thorns in adults, triangular patch of thorns on nape and shoulder, tail longer than body (~60% TL), slender and tapering. Disc rather thick, anterior margin strongly undulate, outer and inner pectoral-fin corners rounded. Snout anterior angle strongly obtuse (115–156°), length ~2.1 times interorbital width; eyes rather large, orbit length ~1.3 times in interorbital width. Tooth rows in upper jaw 30–38. Dorsal disc entirely prickly, pectoral-fin centres smooth in adults. Triangular thorn patch well developed, not reducing in size with growth; median row of small thorns on trunk and tail in juveniles, reduced or lacking in adults; irregular parallel rows of larger thorns extended from shoulders in all stages; no interdorsal thorns. Ventral surface smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials 63–68. Predorsal tail vertebrae 64–77.

COLOUR. Upper surface of disc greyish to medium brown, with or without pattern of darker brown to pale cloudy spots and blotches; tail often with crossbars. Ventral surface largely whitish or with broad dark disc margins and pale areas restricted to belly and pectoral-fin centres.

SIZE. Attains ~56 cm TL. Males and females mature at 45–50 cm TL. Egg cases ~4 cm long and hatch at ~7 cm TL.

HABITAT AND BIOLOGY. North Atlantic and Arctic Seas; Gulf of Biscay (France) to southern Nova Scotia (Canada). Benthic on continental and insular shelves and slopes at 150–2055 m depths. Biology poorly known. Feeds mainly on benthic crustaceans.

SIMILAR SPECIES. Small specimens of Bigelow's Skate (19.127) are similar in general morphology, but the snout of the Round Skate is more obtusely angled in adults, the dorsal disc usually spotted and/or blotched (rather than plain), and the undersurface is mostly white (rather than dark).

MIDATLANTIC SKATE

19.134

Rajella kukujevi (Dolganov, 1985)

LC

IDENTIFICATION. Medium-sized skate with weak rhombic disc (width 1–1.3 times length), snout moderately short with firm rostral cartilage and its tip pronounced, 0–10 orbital thorns, triangular patch of thorns on nape and shoulder, tail about as long as body and slender, and both upper and lower surfaces of disc usually pale. Disc moderately thick, anterior margin strongly undulate, outer and inner pectoral-fin corners rounded. Snout anterior angle moderately acute (79–96°), length 3.1–4.1 times interorbital width; eyes large, orbit length subequal to interorbital width. Tooth rows in upper jaw 35–43. Dorsal disc largely smooth, prickly on anterior margins; triangular patch of thorns on nape and shoulders; median row on posterior trunk and tail with up to 33 thorns, flanked on tail by 2 or 4 parallel rows of thorns; no interdorsal thorns. Ventral surface largely smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials ~69. Predorsal vertebrae ~99.

COLOUR. Upper surface of disc uniformly whitish, pinkish greyish or dark pinkish brown; dorsal fins dusky. Ventral surface pale, white or pinkish; with or without dark margins and dark or blotched tail; no dark-edged sensory pores.

SIZE. Attains ~84 cm TL. Males mature at ~75 cm TL.

HABITAT AND BIOLOGY. North Atlantic; Mid-Atlantic Ridge, Rockall Trough (British Isles) to Spain and possibly off north-western Africa. Demersal on outer continental slope and upper abyssal plain at 750–2190 m depths. Biology unknown.

SIMILAR SPECIES. Distinguishable from most other *Rajella* species of the North-East Atlantic by a typical plain pale coloration on both surfaces in adults. The Deepwater Skate (19.126) is also pale in colour, but has fewer orbital thorns, typically more median thorns (31–41 *vs.* 33 or less), and no parallel or lateral rows of large thorns on the trunk or tail.

LEOPARD SKATE

19.135

Rajella leoparda (von Bonde & Swart, 1923)

LC

IDENTIFICATION. Medium-sized skate with weakly rhombic disc (width 1.1–1.3 times length), snout moderately long with firm rostral cartilage and its tip pronounced, few small rostral thorns, rosette of 5–13 orbital thorns (1–2 over spiracles), triangular patch of thorns on nape and shoulder, tail about as long as body and slender, plain dark upper surface (sometimes with many dark spots), and plain pale or mottled undersurface. Disc flat and rather thin, anterior margins undulate; outer and inner pectoral-fin corners rounded. Snout anterior angle moderately obtuse (100–110°), length 2.8–4.4 times interorbital width; eyes rather large, orbit length subequal to interorbital width. Tooth rows in upper jaw 52–70. Dorsal disc largely smooth, prickly on anterior margins; triangular patch of thorns on nape and shoulders; median row of 19–29 widely spaced thorns on trunk and tail, flanked by parallel row on each side on trunk and 2–3 rows on tail; interdorsal thorn sometimes present. Ventral surface prickly in young, smooth in adults. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margin, separated at base. Predorsal tail vertebrae 55–58.

COLOUR. Upper surface of disc plain, dark greyish to brownish; sometimes (especially in juveniles) with numerous dark spots. Ventral surface mottled grey and white; population off north-western Africa brownish with light areas on oronasal region, gills and belly.

SIZE. Attains ~95 cm TL. Males and females mature at ~60–70 cm TL; smallest known specimen 15 cm TL. Egg cases ~5 cm long.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Mauritania to South Africa. Benthic on continental slope at 130–1920 m depths. Biology poorly known. Feeds on benthic crustaceans, polychaetes and small fishes.

SIMILAR SPECIES. Distinguishable from other *Rajella* species of the Eastern Atlantic by its larger size, subtly more flattened disc, and darker dorsal surface.

SAIL SKATE

19.136

Rajella lintea (Fries, 1838)

LC

IDENTIFICATION. Large skate with weak rhombic disc (width ~1.2 times length), snout moderately long with firm rostral cartilage and its tip pronounced, orbital thorns well separated in young and forming only indistinct rosette in adults, loosely set thorns on nape and shoulder (not forming a triangular patch), tail slightly longer than body and slender, and upper surface of disc darker than undersurface. Disc rather thick, anterior margins slightly convex in young and females; strongly undulate in mature males; outer and inner pectoral-fin corners rounded. Snout anterior angle moderately acute (~90–100°), length 2.7–3.3 times interorbital width; eyes large, orbit length about equal to interorbital width. Tooth rows in upper jaw 41–50. Dorsal disc entirely and sparsely covered with denticles, irregular double row of up to 40 thornlets on rostrum; pelvic fins smooth and tail prickly; nuchal 2–4 and spiracular thorns 1–2, and mostly 3 thorns on each shoulder; continuous median row of 39–44 close-set, curved thorns (median row on tail surrounded by narrow naked strip); regular lateral row of 50–60 hooked thornlets along each lower edge of tail; no interdorsal thorns. Ventral surface smooth. Pelvic fins moderately large, not deeply incised. Small dorsal fins with rounded margins, close-set or confluent at bases. Pectoral-fin radials 82–84. Predorsal tail vertebrae 68–72.

COLOUR. Upper surface of disc plain brownish to dark greyish brown; pelvic and dorsal fins white-edged. Ventral surface largely creamy white with brownish areas on pectoral-fin margins, cloaca, anterior pelvic-fin lobes, and dark brown median stripe along entire tail.

SIZE. Attains ~125 cm TL. Males mature at ~90 cm TL; young hatch at ~15 cm TL.

HABITAT AND BIOLOGY. North Atlantic and Arctic Seas; Rockall Trough (British Isles) to Grand Banks (off Newfoundland). Benthic on continental and insular shelves and slopes at 150–1500 m depths. Biology poorly known. Feeds on benthic invertebrates and fishes.

SIMILAR SPECIES. Distinguishable from other *Rajella* species of the North Atlantic by its large size, white-edged dorsal fins, and white undersurface with the cloaca flanked by a pair of brown blotches.

BLACKISH SKATE

19.137

Rajella nigerrima (de Buen, 1960)

LC

IDENTIFICATION. Small skate with weak rhombic disc (width ~1.1 times length), snout moderately long with firm rostral cartilage and its tip pronounced, few rostral thorns, 3–4 orbital thorns (preorbit 1 and postorbit 2–3), triangular patch of thorns on nape and shoulder, tail slender and equal to or longer than body (50–60% TL), and both surfaces of disc largely dark, usually almost black. Disc rather thin, anterior margins undulate; outer and inner pectoral-fin corners rounded. Snout anterior angle obtuse, length ~3.1 times interorbital width; eyes moderately large, orbit length about equal to interorbital width. Tooth rows in upper jaw 36–46. Dorsal disc entirely prickly, except anterior pelvic-fin lobes smooth; triangular patch with ~11 thorns; median row on trunk and tail with 32–36 thorns, parallel row irregular; no interdorsal thorns. Ventral surface of disc smooth, tail prickly except for narrow median strip. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials 61–65. Predorsal tail vertebrae 59–65.

COLOUR. Upper surface of disc plain blackish. Ventral surface dark, with white areas confined to areas around mouth, gills and cloaca.

SIZE. Attains ~46 cm TL.

HABITAT AND BIOLOGY. South-East Pacific; Ecuador to Chile. Benthic on continental slope at 590–1000 m depths. Biology unknown.

SIMILAR SPECIES. The Galapagos Skate (19.131) is similar, but has very distinct white patches on a dark ventral surface, the 3 rows of median thorns start beside the pelvic fins, and the undersurface of the tail is entirely prickly. Also resembles the Brazilian Skate (19.141) which has a paler dorsal disc and the undersurface of the tail is smooth.

SPARSETHORN SKATE

19.138

Rajella paucispinosa Weigmann, Stehmann & Thiel, 2014

NE

IDENTIFICATION. Small skate with a heart-shaped disc (width ~1.2 times length), snout short with firm rostral cartilage and its bluntly rounded tip not pronounced, 1 small preorbital thorn and a small postorbital thorn, 1 small nuchal thorn, small scapular thorn present (no triangular patch of thorns on nape and shoulder), tail slightly longer than body and slender (~55% TL), dorsal surface plain white, and undersurface greyish white. Disc rather thick, anterior margins strongly undulate; outer pectoral-fin corners broadly rounded. Snout angle moderately obtuse (~102°), length ~3.6 times interorbital width; eyes rather large, orbit length ~1.4 times interorbital width. Tooth rows in upper jaw ~31. Dorsal disc almost entirely prickly. Thorns in median row of trunk and tail ~17, small, without parallel thorn rows; tail with hooked thornlets along its posterior 2/3; no interdorsal thorns. Ventral surface of disc smooth, tail densely set with coarse spinules. Pelvic fins moderately large, deeply incised. Small dorsal fins with rounded margins, confluent at bases. Pectoral-fin radials ~55–56. Predorsal tail vertebrae ~66.

COLOUR. Upper surface of disc and tail (including orbits) plain white. Ventral surface uniformly greyish white; sensory pores not dark-edged.

SIZE. Attains ~50 cm TL.

HABITAT AND BIOLOGY. Western Indian Ocean; off Mozambique. Benthic on mid-continental slope at 1230–1260 m depths. Biology unknown.

SIMILAR SPECIES. Differs from its congeners in having relatively few thorns on the dorsal surface. The only other member of the genus *Rajella* with both upper and lower surfaces uniformly white, the MidAtlantic Skate (19.134) from the North Atlantic, attains a larger size and has many more thorns on the dorsal surface.

PURPLEBELLY SKATE

19.139

Rajella purpuriventralis (Bigelow & Schroeder, 1962)

LC

IDENTIFICATION. Medium-sized skate with a spade-shaped disc (width ~1.1 times length), snout long with firm rostral cartilage and its tip pronounced, 2–3 orbital thorns (preorbit 1 and postorbit 1–2), no obvious triangular patch of thorns on nape and shoulder, tail slightly longer than body and slender (~53% TL), and both surfaces of disc dark with ventral surface darker. Disc rather thin, anterior margins almost straight; outer and inner pectoral-fin corners broadly rounded. Snout anterior angle acute (~85°), length 3.5–3.9 times interorbital width; eyes rather small, orbit length ~0.7 times interorbital width. Tooth rows in upper jaw 32–42. Dorsal disc entirely prickly; few orbital, nuchal and scapular thorns; median row of ~43 sharp and rather widely spaced thorns on trunk and tail; 2 additional irregular parallel rows of thornlets on tail; no interdorsal thorns. Ventral surface of disc smooth, edges and distal part of tail prickly. Pelvic fins moderately large, deeply incised. Small dorsal fins with rounded margins, fins joined at bases.

COLOUR. Upper surface of disc plain dark grey. Ventral surface blackish.

SIZE. Attains at least 65 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Mexico to French Guiana. Benthic on mid- and lower continental slope at 730–2010 m depths. Biology unknown.

SIMILAR SPECIES. The only other member of the genus *Rajella* found in the Western Atlantic, the Sooty Skate (19.132), has a distinctive heart-shaped disc with a more obtuse and bluntly rounded snout. Placement of the Purplebelly Skate in the genus *Rajella* has been questioned but seems to be supported by molecular evidence.

SMOOTHBACK SKATE

19.140

Rajella ravidula (Hulley, 1970)

LC

IDENTIFICATION. Medium-sized skate with weak rhombic disc (width 1.1–1.2 times length), snout moderately long with firm rostral cartilage and its tip pronounced, 6–8 orbital thorns (preorbit 3–4, postorbit 3 and spiracle 0–1), well-developed triangular patch of thorns on nape and shoulder, tail about as long as body and slender, and disc plain greyish above and largely pale below. Disc rather thick, anterior margin weakly undulate, outer and inner pectoral-fin corners rounded. Snout anterior angle moderately acute (~91–92°), length 4.3–4.8 times interorbital width; eyes rather large, orbit length ~1.1 times interorbital width. Tooth rows in upper jaw 39–44. Dorsal disc covered with widely spaced denticles, tail sides spinulose but back largely without denticles; triangular patch of up to 15 thorns on nape and shoulder; no median thorn row, instead 2 parallel rows on trunk and tail; no interdorsal thorns. Ventral surface entirely smooth. Pelvic fins moderately large, not deeply incised. Dorsal fins with rounded margins, confluent at bases. Predorsal tail vertebrae 69–70.

COLOUR. Upper surface of disc plain pale greyish, darker along posterior margins of disc and pelvic fins; dorsal fins blackish. Ventral surface white to pale yellowish, posterior margins dusky; tail largely dark or mottled, base largely white and tip mottled greyish and white.

SIZE. Attains ~79 cm TL. Males mature at ~70–72 cm TL, females 65–73 cm TL. Egg cases ~9 cm long.

HABITAT AND BIOLOGY. Eastern Atlantic; Morocco to South Africa, distribution patchy. Benthic on upper and mid-continental slopes at 495–1475 m depths. Biology unknown.

SIMILAR SPECIES. Distinguishable from other members of the genus *Rajella* in the Eastern Atlantic by its plain pale grey dorsal disc, black dorsal fins, and double parallel rows of thorns on the trunk and tail but without a median row.

BRAZILIAN SKATE

19.141

Rajella sadowskii (Krefft & Stehmann, 1974)

DD

IDENTIFICATION. Medium-sized skate with subcircular to rhombic disc (width 1.1–1.2 times length), snout rather short with firm rostral cartilage and its bluntly rounded tip not pronounced, 4–13 orbital thorns, triangular patch of up to 11 thorns on nape and shoulder, tail slender and longer than body, and dorsal surface plain white and ventral surface darker greyish white. Disc rather thick, more circular in young; anterior margins weakly undulate (even in adults); outer pectoral-fin corners broadly angular in adults. Snout angle moderately acute in large specimens (92–96°) to obtuse in juveniles (119–128°), length 2.6–3.8 times interorbital width; eyes rather large, orbit length 1.1–1.3 times interorbital width. Tooth rows in upper jaw 37–43. Dorsal disc almost entirely prickly. Thorns of median row on trunk and tail 21–29, small (reduced in size with growth); tail with 2–4 regular or irregular parallel rows of 10–55 thorns (thorn sizes increasing with growth); no interdorsal thorns. Ventral surface of disc smooth, tail prickly in adult females. Tail distinctly longer than body in juveniles (55–61% TL), only slightly longer in adults. Pelvic fins moderately large, not deeply incised. Dorsal fins high, confluent at bases. Pectoral-fin radials 61–72. Predorsal tail vertebrae 60–71.

COLOUR. Upper surface medium to dark blackish brown in adults, but light grey in juveniles. Ventral surface light grey to whitish in adults, but dark brown to dusky greyish brown in juveniles.

SIZE. Attains ~75 cm TL. Males mature at ~50 cm TL (male holotype still subadult at 51 cm TL).

HABITAT AND BIOLOGY. South-West Atlantic (off Brazil) and South-East Pacific (off Chile). Benthic on mid-continental slope at 800–1360 m depths, possibly as shallow as 475 m. Biology unknown.

SIMILAR SPECIES. Differs from the Purplebelly Skate (19.139) in having a prickly dorsal surface, dark ventral coloration, and more dominant median row of thorns on the trunk and tail.

OCELLATE SKATE

19.142

Rostroraja ackleyi (Garman, 1881)

DD

IDENTIFICATION. Small skate with a weakly rhombic to heart-shaped disc (width 1.1–1.2 times length), moderately elongate and broadly pointed snout with firm rostral cartilage, large eyes, thorn on each shoulder, thorns in continuous row from nape to first dorsal fin and in 5 rows on tail of adult male, and dorsal surface yellowish brown with light and dark spots and prominent pectoral ocelli. Disc narrow, anterior margin weakly double concave; pectoral apices broadly rounded. Snout length 3.1–3.6 times orbit length; interorbital space subequal to orbit length. Tooth rows in upper jaw ~42–48. Skin largely smooth on upper surface except for snout tip; smooth ventrally, apart from denticle bands at snout tip and along anterior disc margin to just behind level of mouth. Thorns scattered around eye and on snout tip; malar patch well developed beside eye, alar thorns extending well forward on disc in adult males. Tail slender and very depressed (length equal to precloacal length), angular at edge with well-developed lateral folds, no median bulge; sharp thorns in linear median row and 5 similar lateral rows. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins tall, broadly rounded, separated slightly, procaudal length ~1.3 times snout length; caudal fin low.

COLOUR. Yellowish brown above with dense pattern of pale blotches, and light and dark spots; pectoral ocelli prominent with a white-edged, black oval spot surrounded by series of smaller brown spots. Ventral surface uniformly white.

SIZE. Attains at least 41 cm TL, male specimen adult at this size.

HABITAT AND BIOLOGY. Western Central Atlantic; southern Florida (USA) to Cuba, including Gulf of Mexico. Demersal on the continental shelf and upper slope at 30–385 m depths. Biology little known.

SIMILAR SPECIES. The Ocellate Skate has a long row of thorns along the mid-disc and a similar ring-like pectoral marking to the Roundel Skate (19.148), but differs in having a larger eye and possessing a prominent scapular thorn on each shoulder (otherwise absent).

WHITE SKATE

19.143

Rostroraja alba (Lacepède, 1803)

EN

IDENTIFICATION. Gigantic skate with broad rhombic disc (width ~1.5 times length), snout long with firm rostral cartilage and narrowly pointed tip (anterior angle strongly acute), only preorbital and postorbital thorns present in young (forming rosette of small thorns with growth), and upper surface white-spotted. Disc somewhat thickened; anterior margin strongly undulate to biconcave, apex angular, posterior margin strongly convex. Snout with firm, narrow lobe-like tip; snout length ~2.5–3.2 times interorbital width; eyes large, orbit length about equal to interorbital distance. Tooth rows in upper jaw 40–48. Dorsal disc in young largely smooth, prickly on snout and along anterior margins, skin rougher with growth; ventral surface almost entirely smooth in young, becoming more spinulose. Thorns in median row 10–16 thorns in young, and up to 30 in adults on posterior trunk and tail; lateral row of 7–17 thorns in young, and 17–39 in adults along lower edges of tail; 0–2 interdorsal thorns. Tail slightly shorter than body (~48% TL), broad and depressed at base, tapering distally. Pelvic fins rather large, not deeply incised. Small dorsal fins with rounded margins, bases separated slightly. Pectoral-fin radials 104–105. Predorsal tail vertebrae 59–65.

COLOUR. Upper surface reddish brown in young; greyish blue in adults with a more or less distinct pattern of numerous pale spots. Ventral surface white, with dark disc margins (fading with growth); tail dusky.

SIZE. Attains ~240 cm TL. Off South Africa, males mature at 152–170 cm TL, females ~195 cm TL; in North-West Atlantic, males mature at ~120 cm TL, females ~130 cm TL. Egg cases ~15–20 cm long and hatch at ~30 cm TL.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; British Isles to Mozambique, including Mediterranean Sea. Benthic on continental shelf and slope at 10–750 m depths, possibly down to 800 m. Feeds on benthic invertebrates and fishes. Adult females produce 55–158 egg cases each year.

SIMILAR SPECIES. Distinguished from other similar skates of the region by its very large size, relatively long and narrowly pointed snout, white ventral disc with broad blackish margins, and mucous pores without dark edges.

BAHAMA SKATE

19.144

Rostroraja bahamensis (Bigelow & Schroeder, 1965)

DD

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width 1.2–1.3 times length), moderately elongate and narrowly pointed snout with firm rostral cartilage, rather large eyes, 0–3 nuchal thorns and 3 rows of tail thorns, incomplete rosette of thorns around orbital rim, and greyish brown above with 2 pairs of dark pectoral ocelli. Disc anterior margin double concave in adult males, otherwise undulate; pectoral apices angular. Snout length 3.6–4.5 times orbit length; interorbital space subequal to orbit length. Skin entirely smooth on upper surface; smooth ventrally apart from dense band at snout tip and along anterior disc margin to just behind level of mouth. No lumbar, shoulder or rostral thorns, long malar patch in adult males. Tail slender and very depressed (equal to precloacal length), angular at edge with well-developed lateral folds, no median bulge; sharp thorns in staggered median row and linear lateral rows. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins broadly rounded, separated slightly, procaudal length subequal to snout length; caudal fin low.

COLOUR. Pale greyish brown with 2 pairs of small, dark pectoral ocelli; main ocelli varying from a solid spot, to a ring with its edge either paler or darker than its centre; posterior ocellus slightly smaller resembling a spot. Ventral surface uniformly pale; sensory pores not dark-edged, indistinct.

SIZE. Attains ~54 cm TL. Males mature at ~34 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Bahamas and southern Florida (USA). Demersal on continental and insular slopes at 365–410 m depths. Biology little known.

SIMILAR SPECIES. Similar to the nearby Ocellate (19.142) and Roundel (19.148) Skates that also have prominent ocelli-like pectoral markings. However, the Bahama Skate differs from these species in lacking a continuous row of thorns along the mid-disc.

VENEZUELA SKATE 19.145

Rostroraja cervigoni (Bigelow & Schroeder, 1964)

NT

IDENTIFICATION. Medium-sized skate with a very broad rhombic disc (width 1.4 times length), short and broad snout with firm rostral cartilage, orbital and nuchal thorns, row of thorns extending from mid-disc to first dorsal fin, 3 rows of tail thorns, very widely spaced dorsal fins, and brownish above with ring-like pectoral markings. Disc anterior margin undulate; pectoral apices narrowly rounded. Snout length ~2.9 times orbit length; interorbital space subequal to orbit length. Tooth rows in upper jaw ~42. Skin entirely smooth on upper surface; largely smooth ventrally, apart from band extending along anterior disc margin to opposite mouth. Thorns at snout tip, in rosette around eye and in lumbar region; 3 nuchal thorns; absent from shoulder; extent of malar and alar patches of adult males unknown. Tail slender and depressed (slightly longer than precloacal length), angular at edge with well-developed lateral folds, no median bulge; tail thorns alternating in size, in median row and lateral row on each side. Pelvic fin large, anterior lobe shorter than posterior lobe. Dorsal fins tilted, separated by more than their base lengths, procaudal length 1.5 times snout length; caudal fin low. Pectoral-fin radials 65–74. Predorsal vertebrae 66–72.

COLOUR. Uniformly pale brown above; pectoral ocelli consisting of thin dark ring surrounding a few small dark spots. Ventral surface greyish brown, often with darker blotches on tail; sensory pores not dark-edged, indistinct.

SIZE. Attains at least 51 cm TL. Males mature by 50 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Venezuela to Suriname. Demersal on the continental shelf at 35–175 m depths. Biology little known.

SIMILAR SPECIES. The Eyespot Skate (20.3) appears similar in shape, but lacks nuchal thorns and has dark sensory pores on the ventral surface. The Venezuela Skate's disc is also proportionally wider than the other 2 ocellate skates of the Western Central Atlantic, the Ocellate Skate (19.142) and Roundel Skate (19.148).

CLEARNOSE SKATE

19.146

Rostroraja eglanteria (Bosc, 1800)

LC

IDENTIFICATION. Medium-sized skate with a broad rhombic disc (width ~1.2 times length), moderately elongate and broadly pointed snout with firm rostral cartilage, small eyes, thorns in continuous row from nape to dorsal fins, and upper disc with distinctive pattern of dark crossbars and lacking pectoral ocelli. Disc anterior margin undulate to concave, pectoral radials extend slightly anterior to mid-length of snout; pectoral apices narrowly rounded. Snout length ~4.8 times orbit length; interorbital ~1.3 times orbit length. Tooth rows in lower jaw 46–54. Upper surface uniformly but sparsely covered with large granulations in young, skin becoming progressively smoother on pectoral fins in adults; skin smooth below apart from denticle patch at snout tip and along anterior disc margin. Young with 3–4 thorns around orbital rim and large thorn on each shoulder; disc thorns becoming reduced or lost with age; small malar patch in adult males. Tail rather broad based and depressed, longer than disc; edge angular with well-developed lateral folds tapering and lacking median bulge; sharp thorns of similar size in dense median and lateral rows. Pelvic fin large, anterior lobe much shorter than posterior lobe; adult male clasper very broad, flattened. Dorsal fins narrowly rounded, separated slightly, procaudal length ~1.3 times snout length; caudal fin short, low.

COLOUR. Greyish to brownish above with pattern of spots and narrow, darker brown, transverse and diagonal bars; palest beside snout. Ventral surface uniformly pale; sensory pores indistinct, not dark-edged.

SIZE. Attains ~84 cm TL. Males mature at ~54 cm, females ~60 cm TL; young hatch at 13–14 cm TL.

HABITAT AND BIOLOGY. Western Atlantic; Massachusetts to southern Florida, and eastern and northern Gulf of Mexico. Demersal on continental shelf and upper slope, from the shore to 330 m depth. Feeds on worms, crustaceans and small bony fishes.

SIMILAR SPECIES. A combination of coloration and thorn distribution on the disc make this species unique within the family in the Western Atlantic.

EQUATORIAL SKATE

19.147

Rostroraja equatorialis (Jordan & Bollman, 1890)

DD

IDENTIFICATION. Small to medium-sized skate with a heart-shaped disc (width 1.1 times length), short and narrowly pointed snout with firm rostral cartilage, large eyes, well-developed thorns about snout, orbits, shoulders and along mid-line of disc, widely spaced dorsal fins, and ocellated colour pattern. Disc anterior margin double concave to undulate; pectoral apices broadly rounded. Snout tip most prominent in females, length 3.1–3.7 times orbit length; interorbital space 1.1–1.3 times orbit length. Tooth rows in upper jaw ~42. Disc with few denticles in adults; undersurface entirely smooth, apart from broad band of fine denticles along margin of snout. Thorns small and sharp; rosette around orbit, 5 nuchals, 1–2 on each shoulder; broad band of lumbar thorns in up to 5 rows in females, and 1 row in males; rows continuous with those on tail; adult male with broad malar patch beside orbit, alar patch well developed. Tail suboval and very slender (equal to or longer than precloacal length), with poorly developed lateral folds, no median bulge; tail spiny, thorns in 3–5 median and lateral rows, separated by smaller thornlets. Pelvic fin large, anterior lobe much shorter than posterior lobe; claspers large, depressed and greatly expanded. Dorsal fins low, procaudal length 1.6–1.7 times snout length; caudal fin lobe-like.

COLOUR. Yellowish brown with reticulations above; 1–2 pairs of finely spotted pectoral ocelli and smaller paired markings elsewhere; dark lines radiate from orbits; dorsal and caudal fins dark brown. Ventral surface pale, central tail usually brownish; sensory pores not dark-edged.

SIZE. Reported to attain 88 cm TL, but probably smaller; male type was mature at 36 cm TL.

HABITAT AND BIOLOGY. Eastern Central and South-East Pacific; Gulf of California (Mexico) to Peru, possibly including Galapagos Islands. Demersal on continental and insular shelves at ~20–200 m depths. Biology largely unknown.

SIMILAR SPECIES. Similar in appearance to the California Skate (19.11), but adult males have a distinctive malar thorn patch and more median thorn rows.

ROUNDEL SKATE

19.148

Rostroraja texana (Chandler, 1921)

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.1 times length), moderately elongate and broadly pointed snout with firm rostral cartilage, large eyes, up to 9 nuchal thorns and weak rosette of thorns around orbit, tail thorns in 3–5 rows in both sexes, and brownish blotched above with prominent pectoral ocelli. Disc shape varying greatly with age; anterior margin deeply concave in adult males, otherwise undulate; pectoral apices narrowly rounded. Snout tip extended, length ~3.5 times orbit length; interorbit slightly broader than orbit length. Tooth rows in lower jaw 44–48. Disc surface largely smooth above, adult with granulations only near snout tip; smooth ventrally apart from dense patch of fine spinules over snout before nostrils. Rarely with lumbar thorns, small malar patch beside orbit in mature males. Tail long, depressed and slender (longer than precloacal length), with thin lateral folds, no median bulge; thorny, rows with alternating small and large hooked thorns. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins low, long, well separated, procaudal length more than 1.5 times snout length; caudal fin long, low.

COLOUR. Brownish above, often with fainter, lighter and darker spots and blotches; pectoral ocelli very prominent, large sharply defined black or dark brown spot surrounded by yellowish ring. Ventral surface uniformly white; sensory pores not dark-edged.

SIZE. Attains ~63 cm TL. Males mature at ~42 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Mexico, from southern Florida (USA) to Yucatan Bank (Mexico). Demersal, young live nearshore in shallow bays, adults offshore on continental shelf; mainly at 5–110 m depths (reported from 185 m). Feeds largely on shrimp and small fishes.

SIMILAR SPECIES. Appears similar in body shape and pectoral ocelli coloration to the Brown Skate (19.115) from the Mediterranean Sea. These species differ markedly in the structure of their claspers.

RASPTAIL SKATE

19.149

Rostroraja velezi (Chirichigno, 1973)

DD

IDENTIFICATION. Medium-sized skate with a very wide rhombic disc (width ~1.3 times length), short and broadly pointed snout with firm rostral cartilage, large eyes, continuous row of 17–30 median thorns along disc and tail, single shoulder thorn and lateral thorn rows on tail in males, broken rosette of thorns around orbital rim, brownish above with white spots and prominent pectoral ocelli. Disc anterior margin double concave; pectoral apices narrowly rounded to angular. Snout length ~2.4 times orbit length; interorbital space narrower than orbit length. Upper surface largely smooth with sparse granulations in young, densest before orbit and on dorsolateral surface of tail but more widespread in adults; uniformly smooth ventrally. Thorns strongly tilted and sharp; those of nuchal region and tail largest, continuous and almost equally large in lateral tail series. Tail depressed and broad (much shorter than precloacal length), with weak lateral folds, no median bulge. Pelvic fin large, anterior lobe much shorter than posterior lobe. Dorsal fins tall and broadly rounded, well separated, procaudal length longer than snout length; caudal fin minute.

COLOUR. Brownish with sparse pattern of white spots and dark pectoral ocelli containing similar white spots; snout palest beside rostral cartilage; dorsal fins dark brown. Ventral surface uniformly pale anteriorly, broad greyish brown margins along apices and hind margins of disc; tail uniformly dark brown; sensory pores not visible.

SIZE. Attains ~83 cm TL. Males mature at ~58–61 cm TL, females ~53–58 cm TL.

HABITAT AND BIOLOGY. Eastern Central and South-East Pacific; Mexico to Peru, including Galapagos Islands. Demersal on continental and insular shelves and slopes at 30–300 m depths. Feeds mainly on decapod crustaceans and small fishes. Life history otherwise little known.

SIMILAR SPECIES. The Equatorial Skate (19.147) has a relatively narrower disc with a uniformly pale undersurface (lacking a prominent dark margin on the pectoral fins).

MELBOURNE SKATE

19.150

Spiniraja whitleyi (Iredale, 1938)

VU

IDENTIFICATION. Very large skate with a rhombic disc (width 1.2 times length) almost entirely covered with granular denticles in all but smallest juveniles, rather short and broad snout with firm rostral cartilage, small eyes, 1–5 nuchal thorns, no malar or orbital thorns, very broad and flattened tail (~0.8 times precloacal length), and skin greyish above with white flecks. Disc anterior margin weakly undulate, its apex broadly rounded, more angular in adults. Snout length 5.2–7.3 and interorbital space 2.2–2.6 times orbit length respectively; snout tip knob-like. Tooth rows in lower jaw ~42. Dorsal disc densely covered above and below with fine regularly spaced denticles; juveniles smaller than 30 cm TL less evenly covered ventrally. Tail short, tapering, lateral folds prominent; 1–3 rows of thorns, lateral rows located near skin folds. Pelvic fin large, anterior lobe considerably shorter than posterior lobe. Dorsal fins large, broadly rounded, close together or connected, at end of tail. Pectoral-fin radials 92–98. Predorsal vertebrae 84–89.

COLOUR. Dorsal surface greyish brown or grey, overlain with an irregular pattern of fine white flecks; juveniles with dark blotch on each side of disc. Ventral surface uniformly whitish or scattering of greyish patches.

SIZE. Attains ~200 cm TL. Males mature at ~127 cm TL; egg cases ~22 cm long and young hatch at ~20 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean and South-West Pacific; off southern Australia. Demersal on hard bottoms of continental shelf and upper slope; mainly close inshore but recorded to 345 m depth. Feeds primarily on crabs, octopuses and small bony fishes.

SIMILAR SPECIES. A relatively short snout, large size and a very rough body on both dorsal and ventral surfaces, distinguish this species from all other Australian skates.

ARGENTINE SKATE

19.151

Zearaja argentinensis (Díaz de Astarloa, Mabragaña, Hanner & Figueroa, 2008)

NE

IDENTIFICATION. Medium-sized skate with a rather smooth rhombic disc (width 1.2–1.3 times length), elongate and bluntly pointed snout with firm rostral cartilage, nuchal thorn present or absent, orbital thorns small, long and narrow tail (0.8–0.9 times precloacal length), and purplish brown dorsally and similarly dark ventrally. Disc margin strongly concave anteriorly, apex narrowly rounded. Snout length 6.2–7.9 and interorbital space 1–1.5 times orbit length respectively. Tooth rows in lower jaw 34–43. Disc almost entirely smooth; denticles confined to snout tip on both surfaces; 0–1 nuchal thorns, no scapular thorns, presence of malar thorns unknown. Tail rather slender, with or without weak median bulge before first dorsal fin, lateral folds well developed posteriorly; only median thorn row present. Pelvic fin rather small, anterior lobe slightly shorter than posterior lobe; clasper shape unknown. Dorsal fins broadly rounded, separated slightly; caudal fin well developed, long, low.

COLOUR. Dorsal surface plain purplish brown with darker brown margins on pectoral and pelvic fins, no mottling or spotting; dorsal fins brownish; rostral cartilage barely contrasted with sides of snout adjacent cartilage. Ventral surface of disc brownish, darkest centrally; anterior pelvic-fin lobes darker than posterior lobes; tail brown; sensory pores not distinct.

SIZE. Females attain at least 94 cm TL; largest male known still immature at 77 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; off Argentina. Demersal on mid-continental shelf at 85–140 m depths. Biology unknown.

SIMILAR SPECIES. Placement in the genus *Zearaja* is based on molecular evidence, but needs to be confirmed from the examination of an adult male clasper. Probably confused with the Yellownose Skate (19.152) also found off Argentina, but has a longer and more slender tail with fewer thorn rows.

YELLOWNOSE SKATE

19.152

Zearaja chilensis (Guichenot, 1848)

VU

IDENTIFICATION. Large skate with a broad rhombic disc (width 1.2–1.3 times length), elongate and pointed snout with firm rostral cartilage, single nuchal thorn, malar thorn patch present, rosette of weak thorns around orbital rim in adults, short and broadly flattened tail (0.6–0.8 times precloacal length), and darker dorsally than ventrally. Disc margin double concave anteriorly in adult males (less so in immatures and females), apex narrowly rounded to angular. Snout length 5.4–6.5 and interorbital space 1.8–2.1 times orbit length respectively. Tooth rows in lower jaw 25–35. Skin surfaces largely smooth, denticles confined to snout and anterior margins of disc. Thornlets on tip of rostrum; no scapular thorns. Tail broad, depressed, tapering, lateral folds well developed; adult males with sparse median and lateral thorns (often lost in adults); additional row of more ventrally positioned lateral thorns on each side in adult females, median row usually with weak thorns and smaller interstitial thorns. Pelvic fin posterior lobe small, anterior lobe large; clasper tips spatulate. Dorsal fins broadly rounded, close together; caudal fin low, connected to second dorsal fin at its base.

COLOUR. Dorsal surface dark brown, usually with indistinct paler markings and large black blotch on each side of disc; rostral cartilage dark brown and contrasted strongly with adjacent paler snout; orbit margin white. Ventral surface dusky white; dark brown or grey areas on mid-line of snout, around oronasal region, central disc and tail; sensory pores dark-edged, rarely encircled by dark blotch.

SIZE. Attains ~168 cm TL. Males mature at 76–90 cm TL, females 94–104 cm TL. Egg cases 9–16 cm long. Smallest known specimen 16 cm TL.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; central Chile to Uruguay. Demersal on continental shelf and slope at 15–600 m depths, possibly to 1000 m. Breeds throughout the year, and thought to live up to 21 years.

SIMILAR SPECIES. Resembles *Dipturus* skates off South America but has a shorter tail and different squamation and claspers. Has been confused with the Argentine Skate (19.151), but has a shorter, broader and spinier tail.

MAUGEAN SKATE

19.153

Zearaja maugeana Last & Gledhill, 2007

EN

IDENTIFICATION. Medium-sized skate with a rhombic disc (width ~1.1 times length), very elongate and narrowly pointed snout with firm rostral cartilage, 2 nuchal thorns, small malar thorn patch, rosette of slender orbital thorns in adults, short and flattened tail (0.6–0.7 times precloacal length), and both surfaces of disc dark. Disc anterior margin deeply concave, its apex narrowly rounded to angular. Snout length 5.7–6.7 and interorbital space 1.5–1.7 times orbit length respectively. Tooth rows in lower jaw 39–42. Dorsal denticles on central and anterior margins of snout, interorbit, and in prominent band along mid-line (more widespread over disc in large females); ventrally, confined to snout and anterior margins of head. No scapular thorns. Tail broad, tapering slightly, lateral folds well developed; median and dorsolateral thorn rows in adult males, usually 1–2 short rows of thorns above and below dorsolateral row in adult females; median row staggered with large thorns and smaller interstitial thorns. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe; clasper tips spatulate. Dorsal fins low, broadly rounded, close together; caudal fin short based, low. Pectoral-fin radials 78–85. Predorsal vertebrae 85–93.

COLOUR. Dorsal surface greyish to black with widely spaced whitish spots or blotches (often indistinct); rostral cartilage strongly contrasted with snout. Ventrally, greyish or blotched, paler than dorsal surface; sensory pores dark-edged, rarely surrounded by dark blotch.

SIZE. Attains at least 84 cm TL. Males smaller to ~71 cm TL and maturing at ~65 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean; endemic to Australia. Freshwater, brackish and marine, confined to 2 large estuaries in south-western Tasmania.

SIMILAR SPECIES. Snout more elongate than other inshore skates of temperate Australia. Similar to the larger and more widespread marine species, the New Zealand Rough Skate (19.154), but has smoother skin and a slightly narrower disc, longer ventral head, and less robust tail.

NEW ZEALAND ROUGH SKATE

19.154

Zearaja nasuta (Müller & Henle, 1841)

LC

IDENTIFICATION. Large bulky skate with a rhombic disc (width 1.1–1.2 times length), moderately elongate and narrowly pointed snout with firm rostral cartilage, 1–3 nuchal thorns, narrow malar thorn patch, 3–7 thorns around orbital rim, very flattened tail (0.7–0.8 times precloacal length), and dorsal colour pattern distinct and darker than belly. Disc anterior margin deeply concave, its apex narrowly rounded. Snout length 4.1–5.3 and interorbital space 1.3–1.7 times orbit length respectively. Tooth rows in upper jaw 36–45. Dorsal disc mostly uniformly covered with denticles in adults, prominent band along mid-line of back (about width of tail base) extending onto dorsolateral surfaces of tail; smooth ventrally, apart from head and belly. No scapular thorns. Tail short, tapering, lateral folds well developed; with median thorn row in young, additional lateral row on each side in adults. Pelvic fin medium-sized, anterior lobe much shorter than posterior lobe; clasper tips spatulate. Dorsal fins large, broadly rounded, close together; caudal fin very short. Pectoral-fin radials 84–87. Predorsal vertebrae 89–94.

COLOUR. Dorsal surface variably brownish or greyish, usually also with obvious pattern of black or white spots and/or blotches and reticulations; frequently with a large blackish brown eyespot on pectoral fins (lost when mucus is removed). Ventral surface usually uniformly white with prominent dark-edged sensory pores anteriorly, not encircled by a dark blotch.

SIZE. Attains at least 108 cm TL. Males mature at ~52 cm TL; egg cases 10–13 cm long.

HABITAT AND BIOLOGY. South-West Pacific; endemic to New Zealand. Demersal on continental shelf and upper slope, mainly at 10–660 m depths (possibly deeper to 1450 m). Eggs laid in pairs from October to December. Feeds primarily on benthic crustaceans, polychaetes and bony fishes.

SIMILAR SPECIES. In New Zealand, confused with the New Zealand Smooth Skate (19.47) but has a much rougher skin in adults. The smaller Maugean Skate (19.153) from Australia is similar but has a rougher and a slightly broader disc, shorter snout and head, and a relatively broader tail.

20

SOFTNOSE SKATES

Family Arhynchobatidae

P.R. Last, M.F.W. Stehmann, B. Séret & S. Weigmann

Softnose skates are small to large rays (adults 28 cm to ~2 m TL) with a flattened body, circular, heart-shaped or rhombic disc, pectoral-fin apices broadly rounded to pointed, and a variably angular and flexible snout, sometimes with a prominent lobe at its tip. The disc and tail are well demarcated from each other; a firm, slender tail varies from being much longer to slightly shorter than the disc. Except for *Pseudoraja*, pelvic fins are notched (often very deeply) with distinct anterior and larger posterior lobes (fin hardly divided in *Sympterygia*). The anterior nasal flaps are expanded to form an incomplete nasal curtain. These flaps usually reach the mouth but their posterior margins are not joined like in some other ray groups, such as the stingrays. Tail with 0–2 (mostly 2) small dorsal fins near its tip. The caudal fin is rudimentary with the lower lobe (when present) smaller than the upper lobe. Skin naked or variably covered with granular dermal denticles, some species with entire ventral surface granular. Thorns usually present on tail, but usually not well developed on dorsal surface of disc; variably located on the orbital, nuchal and scapular regions. Adult males have a patch of non-retractable alar thorns on each pectoral fin, and sometimes more anteriorly positioned malar patches. The family includes at least 104 species, some of which are undescribed, in 13 genera: *Arhynchobatis*, *Atlantoraja*, *Bathyraja*, *Brochiraja*, *Insentiraja*, *Irolita*, *Notoraja*, *Pavoraja*, *Psammobatis*, *Pseudoraja*, *Rhinoraja*, *Rioraja* and *Sympterygia*. Skeletal features, particularly the structure of the clasper cartilages, are important in distinguishing genera and species. These characters are often complex and not user-friendly, but softnose skates have some skeletal features unique to the group that need to be mentioned. The rostral cartilage supporting the snout is either absent or flexible and delicate over most, or all, of its length, and its base barely extends forward beyond the leading margins of the nasal capsules (except in *Notoraja* and *Brochiraja*). The anteriormost part of the pectoral-fin skeleton abuts or nearly abuts the snout tip, and the ventral terminal cartilage of the clasper is spoon-shaped, lacks a sharp lateral edge, and does not form an external component, the shield (see Glossary). Softnose skates occur in all oceans, but are most abundant in polar and cool temperate regions; the poorly resolved, species rich genus *Bathyraja* has two major areas of distribution (i.e. the North Pacific and the SW Atlantic). Softnose skates are mostly confined to the deep-sea, where they are demersal on continental slopes and abyssal plains to more than 3000 m depth; most species are mainly benthic, but some larger and more widespread species are benthopelagic. They are mainly active carnivores, feeding on mobile benthic invertebrates and fishes. All species are oviparous, with females laying their eggs in cases on the seafloor. Egg cases are rectangular and flattened in shape with a tough protective outer coating of keratin and a horny structure at each corner. Most species are of no commercial importance, being caught typically in small quantities as bycatch of deepwater trawl and longline fisheries.

KEY TO ARHYNCHOBATID GENERA

The softnose skates are very difficult to characterise based solely on external features because skeletal structures, particularly those of the claspers, are more important in distinguishing groups. Hence, the key below incorporates some technical characters in order to distinguish between the genera. Couplet 4 is complex and readers may need to consult the Glossary for more information. If a specimen fails to key out correctly, we suggest proceeding again from this point using the alternative option in couplet 4.

1. Pelvic fins with single laterally directed lobe, tip broadly rounded and posterior margin transverse (fig. 1); no dorsal fins (fig. 3); Western Central Atlantic .... ***Pseudoraja* (1 species; fig. 3, p. 464)**

   Pelvic fin with anterior and posterior lobes (fig. 2); 1 or 2 dorsal fins (fig. 7) 2

2. Tip of snout rather firm and not pliable; anteriormost extension of pectoral-fin skeleton distinctly separated from tip of snout by semi-translucent area (fig. 4); sensory pores and often canals on ventral surface usually dark-pigmented (fig. 6) 3

   Tip of snout pliable; anteriormost extension of pectoral-fin skeleton abutting or nearly abutting tip of snout, not separated from snout by semi-translucent area (fig. 5); sensory pores and often canals on ventral surface usually not dark-pigmented 4

3. Distance from origin of first dorsal fin to tip of tail (when undamaged) as long as or longer than distance from origin of first dorsal fin to tips of posterior lobes of pelvic fins (fig. 7); South-West Atlantic .... ***Rioraja* (1 species; fig. 7, p. 468)**

   Distance from origin of first dorsal fin to tip of tail considerably shorter than distance from origin of first dorsal fin to tips of posterior lobes of pelvic fins (fig. 8); South-West Atlantic .... ***Atlantoraja* (3 species; fig. 8, pp. 370–372)**

fig. 1

fig. 2

pelvic fins (ventral view)

fig. 3

fig. 4

fig. 5

fig. 6

fig. 7

fig. 8

4. Anterior cranial fontanelle extremely broad, circular (fig. 9), spade-shaped (fig. 10) or broadly teardrop-shaped (fig. 12) (press into the skin over the cranium to find edge of fontanelle); length of fontanelle less than 2.5 times its width at its mid-length; fontanelle either not or only slightly (fig. 12) extending onto rostral cartilage (to about level with leading edges of nasal capsule) 5

   Anterior cranial fontanelle narrowly teardrop-shaped (fig. 14); length of fontanelle more than 2.5 times its width at its mid-length; fontanelle extending well forward onto rostral cartilage (fig. 14, often well forward of leading edges of nasal capsule), except in *Pavoraja* (which lacks a continuous rostral cartilage, fig. 15) ... 10

5. Single, very small dorsal fin located just anterior to large caudal fin (fig. 11); tail length about 53–55% of total length; South-West Pacific .... ***Arhynchobatis*** **(1 species; fig. 11, p. 369)**

   Two small dorsal fins located just anterior to very small caudal fin (fig. 13); tail length usually less than 53% of total length 6

fig. 9

fig. 10

fig. 12

fig. 11

fig. 13

fig. 14

fig. 15

cranium

6. Tip of snout with small fleshy conical or knob-like process (sometimes very small) (fig. 16) 7

   Tip of snout without small fleshy process, not as above 8

7. Disc nearly circular (fig. 15); dorsal surface of disc largely smooth, free of denticles; Australia .... ***Irolita* (2 species; fig. 13, pp. 437–438)**

   Disc weakly angular to heart-shaped (fig. 16); dorsal surface of disc partially to largely covered with denticles and prominent thorns; South-East Pacific and South-West Atlantic ... ***Psammobatis* (8 species; fig. 16, pp. 456–463)**

8. Posterior margin of pelvic fins straight to slightly concave (fig. 18); dorsal surface of disc largely free of denticles and with few thorns (usually confined to orbital rim and nape); South-East Pacific and South-West Atlantic .... ***Sympterygia* (4 species; fig. 17, pp. 469–472)**

   Posterior margin of pelvic fins deeply or noticeably incised (fig. 19); dorsal surface of disc fully or at least partly covered with denticles 9

9. Rostral cartilage segmented at base (fig. 22, usually detectable by touch); tail rather long, length 1.6–1.9 in TL, longer than disc length (fig. 20); North-West Pacific .... ***Rhinoraja* (3 species; fig. 20, pp. 465–467)**

   Rostral cartilage not segmented at base; tail short or moderately elongate, length more than 1.9 in TL, usually equal to or shorter than disc length (fig. 21); cosmopolitan .... ***Bathyraja* (55 species; fig. 21, pp. 373–426)**

fig. 16

fig. 17

pelvic fins (ventral view)

fig. 18

fig. 19

fig. 20

fig. 21

fig. 22

cranium

10. Bifid thorn on middle of snout (sometimes reduced in adults) (fig. 23); South-West Pacific .... ***Brochiraja* (8 species; fig. 24, pp. 427–434)**

    No bifid thorn on snout 11

11. Skin velvety on dorsal surface, and smooth, transparent and loose ventrally; tail extremely elongate, very slender and lacking thorns (fig. 25); Western Pacific and Eastern Indian Oceans .... ***Insentiraja* (2 species; fig. 25, pp. 435–436)**

    Skin not as above; tail short to elongate, not very slender and its upper surface with thorns or thornlets (figs 26, 27) 12

12. Small or very small skates (smaller than 37 cm TL); rostral shaft very short and not continuous (fig. 15); spiracles widely separated, interspiracular width 6.1–7.7% DW (fig. 26); Australia .... ***Pavoraja* (6 species; fig. 26, pp. 450–455)**

    Small to medium-sized skates (adults attaining 37–65 cm TL); rostral shaft continuous, usually narrow (fig. 14); spiracles narrowly separated, interspiracular width 4.8–6.7% DW (fig. 27); Western Pacific and Eastern Indian Oceans .... ***Notoraja* (11 species; fig. 27, pp. 439–449)**

thorn

fig. 23

anterior view of snout

fig. 24

fig. 25

fig. 26

fig. 27

LONGTAIL SKATE

20.1

Arhynchobatis asperrimus Waite, 1909

DD

IDENTIFICATION. Medium-sized skate with an oval to heart-shaped disc covered above with coarse denticles, broad angular snout, orbital and scapular thorn patches well developed in adults, very long slender tail with only 1 dorsal fin and densely covered with short thorns, upper caudal fin enlarged, and usually plain brownish dorsal surface. Disc weakly heart-shaped in adult males, more oval in females and young. Snout flexible, lacking a firm rostral cartilage, its length 3–3.5 times orbit length; interorbital space very narrow, 0.7–0.8 times orbit length. Mouth narrow, nasal flaps very broadly lobed; tooth rows in upper jaw ~30–31. Dorsal disc, tail and fins densely covered in small spiny denticles; clusters of thorns between orbit and spiracle, and a cross-like patch on shoulder in adults; tail thorns typically in 3–5 dense rows separated by smaller thornlets in adults, shape conical in median row; tail and shoulder thorn patches not connected; ventral surface entirely smooth. Tail elongate, undersurface flattened, length 1.2–1.3 times precloacal length; lateral folds well developed, broad near tail tip. Pelvic-fin margin deeply notched. Single dorsal fin tiny, short-based, much smaller than enlarged caudal fin. Predorsal tail vertebrae ~84, abdominal vertebrae ~34, predorsal vertebrae ~118.

COLOUR. Uniformly brownish above, rarely with faint pectoral ocellus. Ventral surface pale, white to weakly translucent; dark blotches may be present on tail.

SIZE. Attains ~75 cm TL. Males mature at ~55 cm TL, young hatch at ~11 cm TL.

HABITAT AND BIOLOGY. South-West Pacific, off New Zealand. Demersal on insular shelves and slopes at 55–1095 m depths, but most abundant at 200–500 m. Caught occasionally as trawl bycatch but little known of its biology.

SIMILAR SPECIES. Unique within all skates of the Western Pacific in having a single dorsal fin and a disproportionately large caudal fin.

SPOTBACK SKATE

20.2

Atlantoraja castelnaui (Miranda Ribeiro, 1907)

EN

IDENTIFICATION. Large skate with a rough rhombic disc, snout moderately elongate, small eyes, no orbital thorns, no nuchal or shoulder thorns, single thorn row on tail, densely dark-spotted upper surface, and undersurface of head much darker than posterior disc. Disc anterior margins undulate, deeply concave in adult males; apices narrowly rounded to abruptly angular. Snout pointed, with small lobe at tip, soft and flexible vertically due to delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip. Upper disc completely prickly to touch, entirely covered with coarse denticles; ventral surface entirely smooth. Thorns of median row 15–21, evenly spaced, confined to tail; alar thorn patch of adult male long and narrow, no malar thorns. Tail slender, rounded, barely tapering, length subequal to or slightly longer than precloacal length; lateral folds narrow. Two small rounded dorsal fins, well separated, with up to 4 thorns in interspace; caudal fin short and rather tall; procaudal length exceeding prespiracular length. Pelvic fin weakly notched, posterior lobe large; clasper rather robust, almost reaching first dorsal fin.

COLOUR. Dorsal surface dark brownish to yellowish brown, with strong pattern of small, reddish or blackish, circular spots over disc and pelvic fins. Undersurface of anterior disc greyish, strongly contrasted with largely whitish posterior disc; sensory and mucous pores distinct, white or marked as black dots and streaks.

SIZE. Attains ~147 cm TL. Males mature at 91–100 cm TL, females 106–114 cm TL. Egg cases 9–12 cm long, young hatch at ~17 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; northern Argentina to southern Brazil. Coastal marine from inshore to 220 m depth. Lays egg cases from January to October. Primarily eats fish, but juveniles also feed on cephalopods and echinoderms.

SIMILAR SPECIES. Two sympatric congeners, the Eyespot (20.3) and La Plata (20.4) Skates, are largely smooth on the upper disc and both of these skates usually have large pectoral markings.

EYESPOT SKATE

20.3

Atlantoraja cyclophora (Regan, 1903)

VU

IDENTIFICATION. Medium-sized skate with a smooth rhombic disc, snout moderately elongate, small eyes, no orbital thorns, no nuchal or shoulder thorns, single thorn row on tail, and brownish with large and very dark pectoral ocelli. Disc anterior margins undulate (barely more so in adult males); apices narrowly rounded to abruptly angular. Snout pointed, with small lobe at tip, soft and flexible vertically due to delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip. Upper disc completely smooth, lacking dermal denticles; ventral surface smooth. Thorns of median row 7–10, often reduced in adults and not evenly spaced, confined to tail; alar thorn patch of adult male long and narrow, no malar thorns. Tail very slender, rounded, tapering slightly, length slightly longer than precloacal length; lateral folds narrow. Two narrow, tilted dorsal fins; separated slightly, with 1–3 thorns in interspace; caudal fin short and rather tall; procaudal length about equal to prespiracular length. Pelvic fin notched, posterior lobe slightly larger than anterior lobe; clasper very long and slender, almost reaching first dorsal fin.

COLOUR. Dorsal surface plain pale to medium pinkish brown, with pair of distinct ocellate pectoral markings consisting of 2 black rings of variable thickness. Greyish ventrally; sensory and mucous pores distinctly marked as black dots and streaks.

SIZE. Attains ~74 cm TL. Males mature at 45–48 cm TL, females 56–59 cm TL in northern part of distribution (males at ~58 cm TL in southern part). Egg cases 6–7 cm long, young hatch at ~10 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; northern Argentina to southern Brazil. Coastal marine from inshore to 100 m depth (occasionally to 320 m). Feeds mainly on benthic invertebrates, also small bony fishes as adults.

SIMILAR SPECIES. Of 2 similar sympatric congeners, the Spotback Skate (20.2) has a rough prickly upper disc covered with numerous circular dark spots; the La Plata Skate (20.4) either lacks or has a faint pectoral marking when present.

LA PLATA SKATE

20.4

Atlantoraja platana (Günther, 1880)

VU

IDENTIFICATION. Medium-sized skate with a broad rhombic disc, snout rather short and eyes small, no orbital thorns, smooth skin, no nuchal or shoulder thorns, single thorn row on tail, and upper surface brownish and usually with large darker brown pectoral ocelli. Disc anterior margins weakly undulate (barely more so in adult males); apices narrowly and abruptly angular. Snout pointed, with small lobe at tip, soft and flexible vertically due to delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip. Upper disc completely smooth, lacking dermal denticles; ventral surface smooth. Thorns of median row 11–14, confined to tail, not evenly spaced and often reduced in adults; alar thorn patch of adult male long and narrow, no malar thorns. Tail very slender, rounded, barely tapering; short, length slightly less than precloacal length; lateral folds well developed. Two small, rounded dorsal fins; well separated, with 2–3 thorns in interspace; caudal fin with rather tall upper and lower lobes; procaudal length well exceeding prespiracular length. Pelvic fin strongly notched, posterior lobe barely larger than anterior lobe; clasper very long and slender, almost reaching first dorsal fin.

COLOUR. Upper surface plain pale to medium brown, sometimes with indistinct pattern of pale spots; usually with darker blotch-like pectoral marking (often obscure). Undersurface of disc greyish; mucous and sensory pores marked as black spots and streaks.

SIZE. Attains ~91 cm TL. Males mature at 62–63 cm TL, females 69–72 cm TL. Egg cases ~7 cm long.

HABITAT AND BIOLOGY. South-West Atlantic; Argentina to southern Brazil. Coastal marine to upper continental slope to 320 m depth (mostly shallower than 100 m). Diet consists of small benthic invertebrates (including small cephalopods) and bony fishes.

SIMILAR SPECIES. Of 2 sympatric congeners, the Spotback Skate (20.2) has a totally prickly upper disc with a pattern of numerous dark spots; the Eyespot Skate (20.3) has a distinctive ocellate pectoral marking consisting of 2 blackish concentric rings.

DEEPSEA SKATE

20.5

Bathyraja abyssicola (Gilbert, 1896)

DD

IDENTIFICATION. Large skate with a flabby disc, broad head, long triangular snout, velvety skin on both surfaces with few thorns in adults, and dark on both surfaces. Disc heart-shaped in adults, anterior margins undulate in young, apices broadly rounded. Snout broadly elongate with a small apical lobe; soft and flexible vertically due to very delicate rostral cartilage, 4.6–5.7 times orbit length; interorbital space 1.3–1.6 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps broadly lobed; tooth rows in upper jaw 30–38. No thorns around orbital rim, or on shoulder and lumbar regions; 1–5 (usually 3) large nuchal thorns, widely disconnected from median row of 22–31 regularly arranged thorns along tail to first dorsal fin. Upper surface of disc velvety to touch, densely covered with fine denticles; undersurface smooth in young, disc becoming velvety in adults. Tail slender, tapering evenly, subequal to precloacal length; 2 low dorsal fins barely separated, usually 1 thorn in interspace, predorsal length usually shorter than snout length; caudal fin long and low. Pelvic fin weakly notched, anterior lobe short, clasper very long and slender. Pectoral-fin radials 84–87. Predorsal vertebrae 114–120; abdominal vertebrae 32–42, predorsal tail vertebrae 67–78.

COLOUR. Upper surface dark greyish brown to brown, spines pale and typically contrasted against skin. Ventral surface dark brown, often with white patches around mouth and on belly; sensory pores not visible; dorsal and caudal fins uniformly brownish or greyish.

SIZE. Attains ~157 cm TL. Males mature at ~110 cm TL; egg cases ~11 cm long.

HABITAT AND BIOLOGY. North Pacific; Japan to California (USA). Demersal, continental and insular slopes, and abyssal plain, at 360–2905 m depths. Discarded occasional bycatch of local trawl fisheries and biology not well known.

SIMILAR SPECIES. Several other *Bathyraja* skates of the North Pacific are dark all over the body, but none has such a long snout combined with fine prickly skin on both upper and lower surfaces of the disc.

AGUJA SKATE

20.6

Bathyraja aguja (Kendall & Radcliffe, 1912)

DD

IDENTIFICATION. Medium-sized skate with a wide heart-shaped disc, short snout, largely smooth dorsal disc with no thorns forward of or on shoulder girdle, single row of tail thorns extending forward to mid-disc, narrow interorbital space, tail length more than 60% of disc width, and almost uniformly brown on both surfaces. Disc anterior margins increasingly more concave with size; apices more broadly rounded in young. Snout with a short, blunt tip, length 2.3–2.9 times orbit length, interorbital space narrower than orbit length; soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending to snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw ~34. Thorns tall and sharp, closely spaced, confined to ~30 in regularly arranged median row from just behind shoulder girdle to first dorsal fin; 1–2 interdorsal thorns. Upper surface of disc with small patches of widely spaced stellate denticles mainly on snout tip, between orbits and along central anterior margins of disc; pair of dense bands of finer prickles extending over lumbar region and along each side of tail, prickles absent beside thorns; undersurface smooth apart from dense band of fine prickles on mid-anterior margins of disc. Tail deep, slender, tapering to apex, equal to or slightly longer than disc length; lateral folds not obvious; 2 narrow dorsal fins separated slightly; caudal fin rudimentary. Pelvic fin with a deep notch, anterior lobe long and slender. Pectoral-fin radials 80–83. Predorsal vertebrae ~105–107; abdominal vertebrae 30–33, predorsal tail vertebrae 74–75.

COLOUR. Dorsal surface bluish brown, sensory pores black and very obvious. Dusky ventrally, whitish around mouth; sensory pores not visible on undersurface.

SIZE. Attains at least 48 cm TL; adults unknown, a newborn ~17 cm TL.

HABITAT AND BIOLOGY. South-East Pacific; off northern Peru, probably more widespread. Demersal, upper continental slope to ~980 m depth. Biology unknown.

SIMILAR SPECIES. Occurs together with the larger Peruvian Skate (20.43) but, unlike that species, the Aguja Skate has median thorns on the central disc.

WHITEDOTTED SKATE

20.7

Bathyraja albomaculata (Norman, 1937)

VU

IDENTIFICATION. Medium-sized skate with a largely smooth rhombic disc, short snout, no thorns on upper disc other than median row of large thorns extending from nape to first dorsal fin, and white-spotted colour pattern. Disc with deep concavity beside spiracles in adult males, apices moderately angled to narrowly rounded. Snout bluntly angular, soft and flexible vertically due to very delicate rostral cartilage, and anterior pectoral radials extending nearly to snout tip; length 2–3 times orbit length, interorbital space narrow, equal to or less than orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 26–32. No snout, orbital, or shoulder thorns; usually 21–24 whitish thorns in median row on disc and tail. Upper disc largely smooth, except for dermal denticles on snout, at anterior disc margins and in bands flanking median thorn row; undersurface entirely smooth. Tail robust, short, about equal to or shorter than precloacal length; 2 small dorsal fins at rear of tail narrowly separated. Pelvic fin weakly notched, posterior lobe large; clasper slender. Pectoral-fin radials 83–85. Abdominal vertebrae 31–34, predorsal tail vertebrae 76–82.

COLOUR. Dusky to greyish brown with distinctive white-spotted pattern on upper disc and posterior pelvic lobes; spots loosely scattered, circular, with dark blotches between. Undersurface white, tail often with irregular greyish markings.

SIZE. Females attain ~100 cm TL, males ~85 cm TL. Males mature at ~63 cm TL, females ~65 cm TL.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; southern South America, Chile to northern Argentina (including Falkland Islands). Demersal, inshore on continental shelf and upper slope of South America at 55–945 m depths. Diet of young primarily consists of amphipods, large specimens consume mainly polychaetes.

SIMILAR SPECIES. Absence of thorns on the upper disc (other than those of the median row), along with a distinct pattern of white spots on the dorsal surface, distinguishes this skate from all *Bathyraja* in the South-West Atlantic and off Chile.

ALEUTIAN SKATE

20.8

Bathyraja aleutica (Gilbert, 1896)

LC

IDENTIFICATION. Very large skate with a broad, flabby rhombic disc, very broadly elongate snout (~3/4 of head length), thorns extending along mid-disc from nape onto tail, strong shoulder thorns, and plain coloured above with ventral pattern blotchy. Disc margin straight to undulate anteriorly; apices narrowly rounded. Snout with a blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length 5.3–8.4 times orbit length; interorbital space about twice orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 31–39. Thorns absent from orbit and snout; 1–2 shoulder thorns on each side; 32–40 well-developed and evenly spaced thorns in median row from nape to dorsal fins. Upper surface and tail uniformly granular in young, denticles of adult males becoming sparse on pelvic fins and mid-pectoral region and those on sides of tail thickened; undersurface with minute prickles in adult, including snout forward of mouth. Tail thickened, subtriangular in cross-section, tapering to apex, shorter than disc length; lateral folds restricted to posterior tail; 2 rather large dorsal fins at rear of tail separated slightly, snout ~1.4 times procaudal length; caudal fin short and tall. Pelvic fins small, anterior lobe short and broad, clasper slender. Abdominal vertebrae 35–38, predorsal tail vertebrae 67–74.

COLOUR. Upper surface plain yellowish, becoming greyish in preservative, dorsal fins similar to disc; ventral surface of disc white centrally, darker markings around margin of disc and over tail; sensory pores not marked black.

SIZE. Attains ~154 cm TL. Males mature at ~108–116 cm TL. Young hatch at ~12–15 cm TL, egg cases 12–14 cm long.

HABITAT AND BIOLOGY. North Pacific; Japan to California (USA). Demersal, continental and insular shelves and slopes to ~1600 m depth (usually deeper than 250 m). Bycatch of trawl fishery for halibut and rockfishes.

SIMILAR SPECIES. The Dapplebelly Skate (20.97) also has shoulder thorns and a row of median thorns extending from the head to the first dorsal fin, but lacks denticles forward of the mouth, has a shorter snout, and the skin is covered with small, star-shaped denticles.

LITTLE-EYE SKATE

20.9

Bathyraja andriashevi Dolganov, 1983

LC

IDENTIFICATION. Large skate with a broad oval disc covered with small spinules, obtuse snout, no thorns on disc, very small eyes, tail exceeding 70% of disc width, and upper surface plainer and darker than undersurface. Disc anterior margins weakly convex; apices broadly rounded. Snout with minute lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length 7–7.6 times orbit length; interorbital space 1.4–1.7 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw ~30. Thorns confined to tail, in row of ~25, evenly spaced. Upper disc and tail covered uniformly with fine spinules; smooth ventrally. Tail thickened, somewhat rounded in cross-section, tapering gradually to tip, slightly longer than precloacal length; lateral folds beginning near pelvic fins; 2 small dorsal fins at rear of tail barely separated; caudal fin minute. Pelvic fin strongly notched, anterior lobe short. Pectoral-fin radials ~91. Predorsal vertebrae ~122; abdominal vertebrae ~43, predorsal tail vertebrae ~79.

COLOUR. Upper surface bluish pink, often with variable-sized greyish spots. Ventral surface white, posterior margins of pectoral and pelvic fins dusky; sensory pores not marked black.

SIZE. Adult male reported at 120 cm TL, unconfirmed to 140 cm TL. Egg cases large, 12–13 cm long.

HABITAT AND BIOLOGY. North Pacific; central Japan to Sea of Okhotsk (Russia), but probably much more widely distributed in the North-West Pacific. Demersal, lower continental slope and possibly abyss at 1200–2000 m depths. Lives beyond operating depths of local trawl fisheries and existing specimens caught on deep-sea research voyages. Not well known.

SIMILAR SPECIES. Seldom caught and poorly understood deepwater skate differing subtly from other *Bathyraja* species of the region in the structure of its clasper and eye size (unusually small). More specimens required.

BOTTOM SKATE

20.10

Bathyraja bergi Dolganov, 1983

LC

IDENTIFICATION. Large skate with a rhombic disc, skin granular dorsally, snout broadly elongate (longer than half head length), narrow interorbit, shoulder thorns, median thorns discontinuous from nape to tail, tail longer than 70% of disc width, and disc plain brownish above with paler undersurface. Disc anterior margins undulate, apices narrowly to broadly rounded. Snout with an angular tip, soft and flexible vertically due to very delicate rostral cartilage; length ~4.2–4.6 times orbit length in adults, interorbital space 1.1–1.3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw ~26. Thorns absent from orbit and snout; 0–2 nuchal thorns, single shoulder thorn on each side; 20–24 well-developed thorns in median row on tail before dorsal fins, sometimes with single interdorsal. Upper surface uniformly granular in juveniles (except on anterior pelvic-fin lobe), denticles becoming sparse on mid-pectoral region in adults; undersurface smooth, except at snout tip. Tail stout, tapering to apex, slightly longer than disc length; lateral folds restricted to posterior tail; 2 dorsal fins at rear of tail separated slightly; caudal fin minute. Pelvic fin moderately notched, anterior lobe short and broad, clasper slender. Abdominal vertebrae 33–37, predorsal tail vertebrae 75–81.

COLOUR. Upper surface uniformly dark brown, tips of anterior pelvic lobes white. Ventral surface white, sometimes darker on pectoral- and pelvic-fin margins, near cloaca and clasper tip; sensory pores not marked black.

SIZE. Attains ~102 cm TL; egg cases 11–13 cm long.

HABITAT AND BIOLOGY. North Pacific; central Japan to Sea of Okhotsk (Russia). Demersal, outer continental shelves and upper insular slopes at 70–900 m depths.

SIMILAR SPECIES. Within *Bathyraja* of the North-West Pacific, only the Dapplebelly (20.97) and Aleutian (20.8) Skates have 1 or more thorns on each shoulder. However, both of these species also have median thorns extending well forward onto the disc (rather than being confined to the tail).

BROADNOSE SKATE

20.11

Bathyraja brachyurops (Fowler, 1910)

LC

IDENTIFICATION. Medium-sized skate with a weak rhombic disc covered anteriorly with granular denticles, moderately elongate snout, short tail, thorns confined to median row on disc and tail, and disc darker above than below. Disc margin undulate anteriorly, more so in adult males; apices narrowly rounded. Snout broad, bluntly angled, small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length ~2.9 times orbit length; interorbital space equal to or a little larger than orbit length. Mouth narrow; tooth rows in upper jaw 23–32. No thorns on upper disc other than 22–26 large thorns in median row from nape to first dorsal fin in young, row interrupted in adults (2–4 on nape and 14–23 from posterior trunk to first dorsal fin). Upper disc largely smooth, except for denticles on head, along anterior disc margins, and in broad band flanking median thorn row; undersurface smooth. Tail firm, short, 0.8–0.9 of precloacal length; 2 small rounded dorsal fins, separated slightly, procaudal length subequal to snout length. Pelvic fin moderately notched, anterior lobe often elongate; clasper with bulbous tip. Pectoral-fin radials 83–88. Abdominal vertebrae 29–37, predorsal tail vertebrae 70–76.

COLOUR. Greyish brown above, plain or with reticulate pattern and mostly with whitish pectoral markings. Ventrally white, tail often with irregular greyish blotches.

SIZE. Attains ~125 cm TL. Males mature at ~65 cm TL, females ~67 cm TL (based on population off Uruguay). Egg cases 8–9 cm long.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; Chile to southern Brazil (including Falkland Islands). Demersal, inner continental shelf to upper slope at 30–600 m depths. Diet consists of smaller benthic invertebrates (mainly crustaceans and squids); adults consume largely fishes.

SIMILAR SPECIES. The Whitedotted Skate (20.7) has a distinctive white-spotted colour pattern, and in Cousseau's Skate (20.12) the dorsal fins are joined at their bases and the undersurface of the tail is often darker (almost entirely brown).

COUSSEAU'S SKATE

20.12

Bathyraja cousseauae Díaz de Astarloa & Mabragaña, 2004

NT

IDENTIFICATION. Large skate with a weakly rhombic disc densely covered anteriorly with small denticles, short snout and tail, thorns widely spaced and in continuous median row on disc and tail, and upper disc dark mottled with small ocellate pectoral markings. Disc 1.2–1.4 times length, margin undulate anteriorly, more concave in adult males; apices abruptly angular. Snout broad, bluntly angled, small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length 2.8–4.2 times orbit length; interorbital space 1–1.6 times orbit length. Mouth broad; tooth rows in upper jaw 30–33. No thorns on upper disc other than median row of 7–10 on nape and mid-shoulder, and 14–19 from posterior trunk to first dorsal fin. Skin of upper surface largely rough; undersurface smooth. Tail firm, length 0.9–1.2 times precloacal length; 2 small dorsal fins, joined at bases, procaudal length much shorter than snout length. Pelvic fin moderately notched, anterior lobe often elongate; long slender claspers. Pectoral-fin radials 89–92. Abdominal vertebrae 34–38, predorsal tail vertebrae 78–83.

COLOUR. Upper surface greyish brown to yellowish brown, covered with dark speckled pattern; pectoral marking consisting of large whitish blotch encircled with broad dusky margin; tail with varying numbers of pale crossbars or saddles. Ventral surface white; tail regularly with brown spots or almost entirely brown.

SIZE. Attains at least 122 cm TL (off Falkland Islands). Males mature at ~91 cm TL, females ~98 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic and South-East Pacific; Argentina to southern Chile, including Falkland Islands. Demersal, coastal on mid-continental shelf and slope at 105–1190 m depths. No data available on diet.

SIMILAR SPECIES. The Whitedotted Skate (20.7) has a distinctive white-spotted dorsal colour pattern and lacks a large, blotch-like pectoral marking. The Broadnose Skate (20.11) has the dorsal fins well separated (rather than joined at their bases).

DUSKYPINK SKATE

20.13

Bathyraja diplotaenia (Ishiyama, 1952)

LC

IDENTIFICATION. Medium-sized skate with a broadly rhombic disc at all sizes, short and rather broad snout, uniformly granular dorsal disc in young becoming largely naked in adults, no shoulder thorns and nuchal thorns usually absent, long anterior pelvic-fin lobes, and upper surface plain with pale dorsal snout, and undersurface pale. Disc anterior margins weakly undulate; apices broadly rounded. Snout with a minute blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length ~3–4.2 times orbit length; interorbital space slightly larger than orbit length; anterior pectoral radials extending to nearly snout tip. Mouth medium-sized, nasal flaps broadly lobed. Thorns absent from orbit and snout; 0–1 nuchal thorns; 18–28 small thorns in regularly arranged median row on tail before dorsal fins. Upper surface denticle pattern changing greatly with growth; denticles confined to snout, anterior margins of disc, and in narrow band along mid-disc that extends onto tail in adults, broad patch over interorbit; undersurface always smooth apart from snout tip. Tail slender, thickened, longer than precloacal length; lateral folds restricted to posterior tail; 2 small dorsal fins (procaudal length subequal to snout to mid-eye) barely separated; caudal fin short. Pelvic fin with deep notch; clasper rather broad, tip pointed. Abdominal vertebrae 31–37, predorsal tail vertebrae 70–74.

COLOUR. Upper surface uniformly rosy pink to purplish, white on snout forward of eyes and over anterior lobe of pelvic fin; ventral surface of disc usually white, with greyish blue areas along posterior margins of disc and pelvic fins; sensory pores not marked black.

SIZE. Attains ~88 cm TL. Males mature at ~64–69 cm TL, females 67–70 cm TL; egg cases 11–12 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off eastern Japan. Demersal on insular shelf and slope at ~100–1000 m depths. Bycatch of trawl fishery for cods and rockfishes.

SIMILAR SPECIES. Similar in appearance to several other *Bathyraja* from the North-West Pacific but has relatively larger anterior pelvic-fin lobes.

EATON'S SKATE

20.14

Bathyraja eatonii (Günther, 1876)

DD

IDENTIFICATION. Large skate with a rhombic disc, broadly triangular snout (longer than half head length), upper disc uniformly granular in young and partly smooth in adults, 1–2 nuchal thorns (often absent in adults), and variably patterned above and paler ventrally. Disc anterior margins undulate, more so in adult males; apices broadly rounded. Snout long with a pointed tip; soft and flexible vertically due to very delicate rostral cartilage; length ~5 times orbit length; interorbital space slightly larger than orbit; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed. Thorns absent from orbit, snout and shoulder; 8–18 small thorns in median row on tail before dorsal fins, interdorsal thorn sometimes present. Upper surface of disc and tail uniformly granular in juveniles; denticles sparse on pelvic fin and mid-pectoral region of adults, appearing as a wide median band extending from snout to end of tail; undersurface entirely smooth. Tail thickened, tapering evenly to tip, shorter than disc length in adults; lateral folds extending full length of tail; 2 small dorsal fins at rear of tail separated slightly; caudal fin short. Pelvic fin moderately notched, anterior lobe rather long and broad; claspers stout.

COLOUR. Variable, upper surface plain to marbled, yellowish to greyish brown; undersurface of disc largely white, darker markings often around margin of disc, cloaca and over tail; sensory pores not marked black.

SIZE. Attains ~126 cm TL; egg cases 11–12 cm long.

HABITAT AND BIOLOGY. Southern Ocean; Kerguelen Plateau and widespread off Antarctica. Demersal, on continental and insular shelves and slopes at ~15–1500 m depths. Caught commercially off Kerguelen Island.

SIMILAR SPECIES. Occurs with the Darkbelly Skate (20.32) in the Southern Ocean, but the latter has a largely dark undersurface (rather than being predominantly white) and the median thorn row is continuous from the nape to the first dorsal fin.

CINNAMON SKATE 20.15

Bathyraja fedorovi Dolganov, 1983

LC

IDENTIFICATION. Large skate with an angular rhombic disc, sharply pointed snout, small eyes, granular dorsal disc without thorns, lateral folds extending along full length of tail, and undersurface brownish with white spots. Disc anterior margins straight to weakly undulate anteriorly; apices narrowly rounded. Snout with an angular tip; soft and flexible vertically due to very delicate rostral cartilage; length 5.5–5.8 times orbit length; interorbital space 1.3–1.4 times larger than orbit length; anterior pectoral radials extending nearly to snout tip. Mouth rather broad, nasal flaps broadly lobed; tooth rows in upper jaw 22–23. Thorns confined to mid-line of tail, 22–26 in row along predorsal tail. Skin on upper disc and tail velvety, uniformly covered with small spinules; undersurface entirely smooth, apart from surfaces of lateral folds of tail. Tail thickened, almost rounded in cross-section, tapering to apex, slightly shorter than disc length; 2 small, similar-sized dorsal fins at rear of tail, barely separated; caudal fin low. Pelvic fin mildly notched, anterior lobe short; pectoral-fin radials 71–72. Predorsal vertebrae 93–94; abdominal vertebrae 28–29, predorsal tail vertebrae ~65.

COLOUR. Upper surface uniform cinnamon brown; ventral surface of disc similarly brownish with numerous small white spots; sensory pores not marked black.

SIZE. Possibly attains 150 cm TL, but largest confirmed specimen an adult female (73 cm TL) with two egg cases (~9 cm long).

HABITAT AND BIOLOGY. North-West Pacific; Japan to Sea of Okhotsk (Russia). Demersal on continental and insular slopes at 445–2025 m depths (mostly deeper than 800 m); possibly abyssal and more widespread in North Pacific. Less commonly caught in trawls than other *Bathyraja* skates of the region.

SIMILAR SPECIES. Most similar to the Raspback Skate (20.21) in having few thorns on the disc and closely spaced eyes, but the Cinnamon Skate has a more angular snout and characteristic dark, white-spotted ventral surface (rather than whitish with dark edges).

GREYTAIL SKATE

20.16

Bathyraja griseocauda (Norman, 1937)

EN

IDENTIFICATION. Large, heavy-bodied, rough-skinned skate with a broad rhombic disc largely lacking thorns, short snout, and greyish brown above and whitish below. Disc ~1.3 times length, margin undulate anteriorly, more so in adult males; apices narrowly rounded to abruptly angular. Snout broad, bluntly angled, very small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length 3.1–3.3 times orbit length; interorbital space 1.3–1.8 times orbit length. Mouth broad; tooth rows in upper jaw 30–35. No large thorns on upper disc (long and narrow alar thorn patch in adult males), only a median row of 15–20 thorns along tail to first dorsal fin. Skin of upper surface rough with dense covering of fine denticles; undersurface smooth. Tail firm, length 0.9–1 times precloacal length; 2 small dorsal fins near rear of tail, narrowly separated, usually without thorn in interspace, procaudal length subequal to snout length. Pelvic fin moderately notched, anterior lobe rather elongate; very long slender claspers. Pectoral-fin radials 85–93. Abdominal vertebrae 32–40, predorsal tail vertebrae 74–80.

COLOUR. Upper surface plain, dark greyish brown; juveniles and half-grown specimens often with black-spotted pattern. Ventral side of disc white, with broad dark rear margins. Ventral tail white at base, always with distinct irregular greyish brown markings posteriorly.

SIZE. Attains ~157 cm TL. Males mature at ~120 cm TL, smallest juvenile 13 cm TL.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; Chile to southern Uruguay. Demersal, inshore to outer continental shelf and insular slopes at 30–1010 m depths. Diet consists of benthic crustaceans, squids and small fishes; adults feed primarily on fishes.

SIMILAR SPECIES. Species of *Bathyraja* from the region also lacking thorns on the upper disc include the Cuphead Skate (20.45), which has a very narrowly pointed snout, and the Whitemouth Skate (20.46), which is dark-bellied rather than pale. The Spinytail Skate (20.51), which is of similar size and appearance, is a cold temperate North Atlantic counterpart.

WEST AFRICAN SKATE

20.17

Bathyraja hesperafricana Stehmann, 1995

DD

IDENTIFICATION. Large skate with a very broad rhombic disc, short snout, upper disc largely granular but lacking thorns, denticles absent from pectoral centres and posterior disc, single row of tail thorns, tail longer than 80% of disc width, and disc almost uniformly greyish brown on both surfaces. Disc 1.3–1.4 times wider than long, asymmetrical, its widest point much closer to tail than to snout; anterior margins undulate to weakly convex, adult males unknown; apices narrowly and evenly rounded. Snout with minute lobe at tip, length 1.8–2.6 times orbit length, interorbital space subequal to orbit length; soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending to snout tip. Mouth rather broad, nasal flaps lobed; tooth rows in upper jaw 24–25. Thorns with large bases, evenly spaced, 15–17 in median row on tail. Dorsal denticles coarse and rather dense, confined mainly to head, anterior pectoral-fin margins and in longitudinal band along mid-disc; tail covered with similar prickles but skin smooth beside tail thorns; undersurface uniformly smooth. Tail slender, tapering to apex, ~1.2 times precloacal length; lateral folds weak; dorsal fins low, separated slightly; caudal fin low, long based. Pelvic fin deeply notched, anterior lobe slender and nearly as long as posterior lobe. Pectoral-fin radials ~81. Predorsal vertebrae ~101–107; abdominal vertebrae 34–38, predorsal tail vertebrae 67–69.

COLOUR. Dorsal surface plain greyish brown, darker on central trunk, along disc margin, and on anterior pelvic fin; dorsal fins black. Similarly greyish brown ventrally, whitish around mouth; sensory pores not marked black.

SIZE. Attains ~87 cm TL. Maturity size unknown; egg cases possibly hatch at ~25 cm TL.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Mauritania to Gabon. Demersal on continental slope at 750–980 m depths, but possibly much deeper as egg cases with a full-term embryo taken at 1450–2200 m thought to be this species.

SIMILAR SPECIES. The similar Whitemouth Skate (20.46) has a longer and more pointed snout, and higher vertebral counts.

BERING SKATE

20.18

Bathyraja interrupta (Gill & Townsend, 1897)

LC

IDENTIFICATION. Medium-sized skate with a rhombic disc covered with fine spinules, short snout, 1–2 thorns on each shoulder, nuchal thorn row widely separated from tail thorns, and dorsal surface darker than undersurface. Disc margin undulate anteriorly, more so in adult males, apices narrowly rounded. Snout bluntly angular, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip; length 3.8–4.9 times orbit length in adult, less in young; interorbital space distinctly concave and subequal to orbit length. Mouth rather small; tooth rows in upper jaw 20–33. No snout or orbital thorns; 3 nuchal thorns and mainly 1 shoulder thorn (second rudimentary when present); median row of 17–30 thorns extending from posterior disc and along tail to dorsal fins. Upper disc uniformly covered with very small embedded spinules; undersurface entirely smooth except for snout tip. Tail slender, subequal to precloacal length; 2 small dorsal fins at rear of tail, separated slightly; lateral folds originating near mid-length of tail. Pelvic fin weakly notched, posterior lobe large; clasper slender. Predorsal vertebrae ~95–102; abdominal vertebrae 29–35, predorsal tail vertebrae 62–69.

COLOUR. Dorsal surface dark brown, sometimes with white mottling in adults; covered with numerous dark specks in young. Undersurface largely white, but dark along disc margin, around cloaca, tips of pelvic fins, and over tail.

SIZE. Attains at least 87 cm TL. Males mature at ~67 cm TL, females ~70 cm TL; young hatch at ~16 cm TL.

HABITAT AND BIOLOGY. North Pacific; Bering Sea. Probably locally widespread and benthic on mid-continental and insular slopes to 1370 m depth. Biology unknown.

SIMILAR SPECIES. Belongs to a group of Western and Northern Pacific *Bathyraja* skates that have shoulder thorns and are largely or entirely white on the ventral surface.

KERGUELEN SKATE

20.19

Bathyraja irrasa Hureau & Ozouf-Costaz, 1980

NT

IDENTIFICATION. Large skate with a rhombic disc, rather short and broad snout (shorter than half head length), uniformly granular dorsal disc and tail, orbit thorns present but no other thorns on central disc, dark above, and piebald ventrally. Disc anterior margins undulate, more strongly so in adult males; apices broadly rounded. Snout with a bluntly pointed tip; soft and flexible vertically due to very delicate rostral cartilage; length 3.4–4.6 times orbit length; interorbital space 1.1–1.5 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed. Thorns on disc confined to orbit and alar patch of adult males; distinct thorn on preorbit, often also smaller mid and postorbital thorns; 9–23 small, widely spaced tail thorns in median row before dorsal fins, becoming smaller or rudimentary on posterior third of tail, interdorsal thorns absent. Upper surface of disc and tail densely covered with coarse spinular denticles, smooth areas around extremity of disc and on parts of pelvic fins; undersurface entirely smooth. Tail slightly depressed, tapering strongly to apex, subequal to disc length; lateral folds extending almost full length of tail; 2 small dorsal fins at rear of tail separated slightly; caudal fin rudimentary. Pelvic fin moderately notched, anterior lobe rather long and thick.

COLOUR. Upper surface plain dark greyish brown, often darker brown on tail and along mid-line of disc. Undersurface largely dark brown, but white around mouth, over central abdomen, and usually near base and tip of tail; sensory pores not marked black.

SIZE. Attains at least 120 cm TL; egg cases ~11 cm long.

HABITAT AND BIOLOGY. Southern Ocean, possibly endemic to Kerguelen and Heard Islands. Demersal, insular slopes at 300–1220 m depths; egg cases taken at 140 m depth possibly this species. Frequent bycatch of toothfish fishery.

SIMILAR SPECIES. Occurs in the Southern Ocean with another large *Bathyraja*, Eaton's Skate (20.14), which also has a rhombic disc; the Kerguelen Skate has a plainer dorsal disc, and possesses orbital thorns and darker ventral surface.

ABYSSAL SKATE

20.20

Bathyraja ishiharai Stehmann, 2005

DD

IDENTIFICATION. Large, heavy-bodied skate with a rhombic disc, broad head, moderately elongate snout, skin with sparse coverage of denticles, single thorn row on tail, no thorns on head or central disc, and uniformly darkish on both surfaces. Disc with widest point much closer to end of disc than snout; slightly wider than long; anterior margins undulate in young, becoming concave beside spiracles in adults, apices broadly rounded. Snout broadly triangular in young, relatively shorter in adults with a small pointed tip, length ~3.7–4 times orbit length; interorbital space ~1.1–1.4 times orbit length; soft and flexible vertically due to very delicate rostral cartilage, anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps narrow-lobed; tooth rows in upper jaw 22–29. Thorns in median row on tail 16–18. Upper surface with small patches of coarse denticles near eyes and along disc margin in young, confined to distal half of anterior margins in adult males; undersurface entirely smooth. Tail tapering evenly, length subequal to disc length; lateral folds weak; 2 small dorsal fins separated slightly, usually 1 thorn in interspace; caudal fin low. Pelvic fin notched, anterior lobe short, clasper very long and slender. Pectoral-fin radials ~78. Predorsal vertebrae 94–103; abdominal vertebrae 34–35, predorsal tail vertebrae 59–69.

COLOUR. Upper surface uniformly brownish; anterior pelvic-fin lobes brownish black with pale tips, posterior lobes with dark margin; dorsal and caudal fins dusky brownish. Ventral surface dark brown with white areas on anterior nasal flaps and gill slits, and around mouth; sensory pores not marked black.

SIZE. Attains at least 123 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean and South-West Pacific; Naturaliste Plateau, Tasmania and possibly the Lord Howe Rise (Tasman Sea). Known from three specimens, caught from abyssal depths (2320–2800 m). Possibly also off Tanzania.

SIMILAR SPECIES. Richardson's Skate (20.44) also lacks thorns on the disc, but has more widely spaced eyes and rougher skin on the upper disc.

RASPBACK SKATE

20.21

Bathyraja isotrachys (Günther, 1877)

LC

IDENTIFICATION. Medium-sized to large skate with a rhombic disc, broadly elongate snout (about half head length), granular upper disc, nuchal and shoulder thorns usually present, skin folds confined to posterior tail, and disc darker above than below. Disc anterior margins almost straight anteriorly, with an abrupt concavity just forward of its apex in adult males; apices narrowly rounded. Snout with a blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length ~3.5–4.2 times orbit length; interorbital space slightly larger than orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps broadly lobed. Thorns absent from orbit and snout; single shoulder thorn sometimes present; 1–6 nuchal thorns, continuing posteriorly as median row of smaller lumbar thorns only in young; row of mostly 22–26 regularly arranged median thorns along predorsal tail. Skin of upper disc and tail uniformly granular in females and juveniles, denticles minute and becoming sparse on mid-pectoral and gill region in adult males; anterior pelvic lobe and undersurface smooth. Tail thickened, rounded in cross-section, tapering to apex, subequal in length to disc length; 2 small dorsal fins at rear of tail barely separated; caudal fin minute. Pelvic fin moderately notched, anterior lobe broad; clasper slender. Abdominal vertebrae 34–40, predorsal tail vertebrae 73–82.

COLOUR. Upper surface plain yellowish brown, becoming greyish in preservative, dorsal fins similar to disc; ventral surface of disc white, tail sometimes with dark markings; sensory pores not marked black.

SIZE. Attains at least 93 cm TL; egg cases ~11–13 cm long.

HABITAT AND BIOLOGY. North-West Pacific; Taiwan to Sea of Okhotsk. Demersal, mainly mid-continental and insular slopes at 450–1480 m depths, possibly deeper. Among most common deepwater skates of the Western Pacific.

SIMILAR SPECIES. Most closely resembles the Eremo Skate (20.54) but has a denser coverage of denticles on the dorsal surface and better-developed nape and shoulder thorns.

SANDPAPER SKATE

20.22

Bathyraja kincaidii (Garman, 1908)

DD

IDENTIFICATION. Medium-sized skate with a weak rhombic disc covered dorsally with granular denticles, short snout, shoulder thorns present, nuchal thorn row continuous with tail series, and dorsal surface darker than undersurface. Disc margin undulate anteriorly, more concave in adult males, apices narrowly rounded. Snout broad, small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length 2.9–3.7 times orbit length; interorbital space 1.3–1.6 times orbit length. Mouth small; tooth rows in upper jaw 20–33. No snout or orbital thorns; median row of ~29 thorns extend continuously along disc and tail or isolated in 3 discrete rows; thorns large-based and low anteriorly, more conical on tail. Upper surface rough, uniformly covered with tall stellate denticles, very dense on tail, some embedded; undersurface entirely smooth. Tail long and slender, ~1.2 times precloacal length; 2 rounded dorsal fins at rear of tail, separated slightly, procaudal length ~14% TL; lateral folds originating near mid-length of tail. Pelvic fin weakly notched, anterior lobe rather enlarged; clasper slender. Predorsal tail vertebrae 64–73.

COLOUR. Dorsal surface grey to greyish brown, sometimes with black spots; white pectoral marking and white patch on either side of tail. Ventral surface of disc white; tail often with dark median stripe; sensory pores not black-edged.

SIZE. Attains at least 63 cm TL (possibly to 86 cm TL). Males mature at ~48 cm TL, females 46–50 cm TL. Egg cases ~6 cm long, young hatch at 12–16 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; California to Alaska. Demersal on continental and insular slopes, commonly at 200–500 m depths, but also collected at 1370 m.

SIMILAR SPECIES. Considered by some ichthyologists to be identical with the Bering Skate (20.18), hence the northern range of the Sandpaper Skate is uncertain due to confusion with this species. Molecular analyses are needed to determine the validity of similar species of *Bathyraja*.

DOMINO SKATE

20.23

Bathyraja leucomelanos Iglésias & Lévy-Hartmann, 2012

NE

IDENTIFICATION. Medium-sized skate with a rhombic disc, triangular snout, upper disc granular and entirely lacking enlarged thorns (apart from alar patch in adult males), eyes rather narrowly separated and mouth small, and largely white dorsally and entirely black below. Disc margin deeply concave behind orbit; apices narrowly rounded. Snout rather broad, pointed, small fleshy lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length ~6 times orbit length, interorbital space ~1.4 times orbit length; anterior pectoral radials extending nearly to snout tip. Mouth narrower than its distance from disc margin, nasal flaps strongly lobed; tooth rows in upper jaw ~30. Disc without primary thorns, alar patch well developed; ~18 large, regularly spaced thorns in median row on tail before dorsal fins, no interdorsal thorns. Upper surface almost entirely covered with fine denticles; no denticles on anterior lobe of pelvic fin. Tail ~0.9 times precloacal length, slender, tapering to apex, slightly depressed; lateral folds developed only on posterior half of tail; dorsal fins small, tilted, at rear of tail, barely separated, procaudal length ~13% TL; caudal-fin upper lobe developed. Pelvic fin strongly notched, anterior lobe very short in adult male; clasper very long and expanded distally. Pectoral-fin radials ~88. Predorsal vertebrae ~105; abdominal vertebrae ~35, predorsal vertebrae ~70.

COLOUR. Upper surface predominantly white; disc margin, snout tip, spiracle, anterior lobes of pelvic fins, dorsal fins and claspers black. Ventral surface entirely black, mouth white; sensory pores not marked black.

SIZE. Known from a single adult male, 90 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; Coral Sea (off New Caledonia). Probably benthic and more widespread on deep insular slopes of Coral Sea, at 955–1020 m depths. Life history unknown.

SIMILAR SPECIES. No other *Bathyraja* skate in this part of South Pacific occurs so far north. The Pacific Blonde Skate (20.38) from New Zealand is pale on both surfaces and has an almost entirely smooth disc.

COMMANDER SKATE

20.24

Bathyraja lindbergi Ishiyama & Ishihara, 1977

LC

IDENTIFICATION. Large skate with a rhombic to heart-shaped disc, short and rather broad snout, no scapular or orbital thorns, denticles concentrated into well-defined band extending along mid-disc and onto tail, continuous row of thorns from nape to dorsal fins, and both surfaces brownish with upper disc darker. Disc anterior margins most undulate in adult males, most deeply concave beside nape; apices narrowly rounded to abruptly angular. Snout tip with small blunt lobe; soft and flexible vertically due to very delicate rostral cartilage; length ~3 times orbit length; interorbital space ~1.5 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth very broad, nasal flaps broadly lobed; tooth rows in upper jaw 21–29. Thorns 27–39, well-developed and regularly arranged, in continuous median row on disc and tail. Upper surface of disc rough in patches, absent from mid-pectoral fins and anterior lobes of pelvic fins; undersurface entirely smooth. Tail slender, rounded in cross-section, tapering to apex, slightly longer than precloacal length; lateral folds restricted to posterior tail; 2 dorsal fins at rear of tail barely separated; caudal fin low. Pelvic fin with moderate notch, anterior lobe short and broad; clasper rather broad, tip rounded. Predorsal vertebrae mainly 101–102; abdominal vertebrae 29–34, predorsal tail vertebrae 68–72.

COLOUR. Upper surface uniform dark greyish brown, thorns whitish. Ventral surface of disc paler brown, tail darker greyish brown; sensory pores not marked black.

SIZE. Attains at least 102 cm TL, but probably erroneously reported to reach 126 cm TL. Males and females mature at ~80 cm TL.

HABITAT AND BIOLOGY. North Pacific; Arctic rim, northern Japan to Alaska (USA). Demersal on continental and insular shelves and slopes at 125–1195 m depths. Common bycatch of Bering Sea trawl fishery.

SIMILAR SPECIES. A smooth undersurface, no scapular thorns, continuous row of thorns along mid-disc and tail, and brownish upper and lower surfaces, distinguish this species from all other *Bathyraja* skates in the region.

SLIMTAIL SKATE

20.25

Bathyraja longicauda (de Buen, 1959)

DD

IDENTIFICATION. Medium-sized skate with a rhombic disc, skin on its upper surface largely smooth anteriorly, moderately elongate snout, no thorns on head or shoulders but 26–30 small median thorns extending from posterior half of disc to first dorsal fin, tail long in young, both surfaces of disc very dark. Disc ~1.3 times length, margin undulate anteriorly, more so in adult males; apices narrowly or abruptly rounded. Snout broad, bluntly angled, small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length 3–3.8 times orbit length; interorbital space 1.2–1.5 times orbit length. Mouth narrow, nasal flaps broadly lobed. Alar thorn patch of adult male long, extending forward to anterior edge of disc. In juveniles, dorsal denticles only on snout, interorbital, along anterior disc margins and on sides of tail; in adult males, confined to well-defined narrow median denticle band originating just posterior to mid-disc and extending along tail; undersurface smooth. Tail firm and slender, length 1–1.3 times precloacal length; 2 small dorsal fins, rounded, well separated, 1–2 thorns in interspace, procaudal length subequal to snout length; caudal fin rudimentary. Pelvic fin moderately notched, anterior lobe small; claspers long and very slender.

COLOUR. Upper surface plain medium brown, with snout tip dusky. Ventral surface similarly dark brown; in young, snout tip dusky, and light brown blotches near mouth, and on belly, anterior pelvic lobes, and tail.

SIZE. Attains ~80 cm TL. Males are mature at 71 cm TL.

HABITAT AND BIOLOGY. South-East Pacific; Peru and central Chile. Demersal, probably more widespread along South American continental slope at ~400–735 m depths. Few specimens known.

SIMILAR SPECIES. The Peruvian Skate (20.43) has largely prickly skin on upper disc, a shorter tail (about as long as body), no interdorsal thorns, and fewer (18–26) thorns in median row of tail.

MCCAIN'S SKATE

20.26

Bathyraja maccaini Springer, 1971

NT

IDENTIFICATION. Large skate with a moderately short and rather broad snout, uniformly granular dorsal disc in young becoming smoother in adults, large orbital and shoulder thorns, short tail, and pale patterned above with white undersurface. Disc rhombic to heart-shaped in adults, anterior margins weakly undulate, apices broadly rounded. Snout with a small triangular tip; soft and flexible vertically due to very delicate rostral cartilage; length ~4.2 times orbit length; interorbital space 1–1.4 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw ~29. Thorns absent from central region of disc; single, large preorbital, postorbital and shoulder thorns always present; 9–15 distinct, widely spaced thorns in median row on tail before dorsal fins, interdorsal thorn sometimes present. Upper surface squamation changing with growth; denticles coarse, sparsely scattered along outer margin of disc, over mid-body and on tail; undersurface entirely smooth. Tail shorter than disc in adults; tapering to apex; lateral folds along most of tail; 2 small dorsal fins at rear of tail barely separated; caudal fin short. Pelvic fin with deep notch, anterior lobe moderately elongate; clasper slender, tip rounded. Abdominal vertebrae ~37, predorsal tail vertebrae ~72.

COLOUR. Upper surface dark greyish brown, often with pattern of light spots or blotches that are most obvious in young; also often with 1 or more pairs of pale pectoral ocelli. Undersurface largely white, often with irregular dark speckling or blotches; sensory pores not marked black.

SIZE. Attains ~120 cm TL, males mature at ~94 cm TL.

HABITAT AND BIOLOGY. Southern Ocean; off Antarctica and Kerguelen Island. Demersal on continental and insular shelves and upper slopes to ~500 m depth. Bycatch of trawl and line fisheries for Antarctic icefishes.

SIMILAR SPECIES. McCain's Skate is less spiny than Murray's Skate (20.36), and has prominent thorns around the eye that are absent in Eaton's Skate (20.14).

PATAGONIAN SKATE

20.27

Bathyraja macloviana (Norman, 1937)

NT

IDENTIFICATION. Medium-sized skate with a spiny, heart-shaped disc, very short snout, rather large eyes, nuchal and shoulder thorns, median thorns discontinuous from nuchal region to tail, and disc darker above than below. Disc anterior margins convex beside eyes, apices broadly rounded. Snout length 2.5–3 times orbit length, interorbital space mostly equal to or up to 1.2 times wider than orbit length; small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip. Tooth rows in upper jaw 30–36. Upper disc with well-developed thorn pattern consisting of large orbital, nuchal, mid-shoulder and shoulder thorns; median row of 21–29 strong thorns from lumbar region to first dorsal fin; smaller thornlets and rough denticles scattered all over pectoral fins. Undersurface entirely smooth. Tail broad, tapering, about as long as precloacal length; 2 small rounded dorsal fins at rear of tail, separated with a thorn in interspace. Pelvic fin weakly notched, anterior lobe rather elongate; clasper robust. Pectoral-fin radials 76–82. Abdominal vertebrae 31–37, predorsal tail vertebrae 71–77.

COLOUR. Dorsal surface dark brown to greyish, and often with pair of circular pectoral ocelli (pale centre encircled by large dark ring); similar smaller and fainter ocelli all over pectoral and posterior pelvic fins. Underneath largely white, but often with dusky markings on posterior pectoral- and pelvic-fin margins, vent, and tail tip.

SIZE. Attains ~71 cm TL. Off Falkland Islands, males mature at ~50 cm TL, females ~46 cm TL. Egg cases 7–8 cm long.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; Chile and Argentina. Demersal, inshore on continental shelf to upper slope at 50–515 m depths. Diet consists mainly of benthic polychaetes, and to a lesser extent small crustaceans.

SIMILAR SPECIES. The Magellan Skate (20.29) is largely smooth-skinned on the upper disc (apart from strong thorns on the mid-disc and in row along tail), and has a more complex marbled dorsal coloration.

WHITEBLOTCHED SKATE 20.28

Bathyraja maculata Ishiyama & Ishihara, 1977

LC

IDENTIFICATION. Large skate with a rhombic disc, short and rather broad snout, denticles in well-defined band extending along mid-disc and onto tail, no scapular or orbital thorns, discontinuous median row of thorns, and white blotches of varying sizes on upper disc. Disc anterior margins undulate, apices narrowly rounded. Snout often with minute lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length 2.9–3.7 times orbit length; interorbital space 1.3–1.6 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps narrowly lobed; tooth rows in upper jaw 22–34. Row of 2–5 nuchal thorns and median row of 18–26 tail thorns separated by a gap over belly; thorns large and arranged regularly. Upper surface of disc rough with denticles covering most of disc, absent from snout tip, mid-pectoral fins, and anterior lobes of pelvic fins; undersurface entirely smooth. Tail robust, almost rounded in cross-section, tapering to apex, slightly longer than precloacal length; lateral folds restricted to posterior tail; 2 dorsal fins at rear of tail barely separated; caudal fin developed only on upper surface of tail. Pelvic fin with moderate notch, anterior lobe short and broad; clasper rather broad, tip pointed. Predorsal vertebrae usually 101–104; abdominal vertebrae 31–35, predorsal tail vertebrae 67–75.

COLOUR. Upper surface dark greyish brown, densely mottled with pale blotches. Ventral surface whitish, usually with dark blotches; tail and outer pectoral and pelvic fins usually dark; sensory pores not marked black.

SIZE. Attains ~134 cm TL. Males mature at ~89–96 cm TL, females 94–101 cm TL; egg cases 10–11 cm long.

HABITAT AND BIOLOGY. North Pacific; Arctic rim, northern Japan to Alaska (USA). Demersal on continental and insular shelves and slopes at 75–1195 m depths. Common bycatch of regional trawl fisheries.

SIMILAR SPECIES. Resembles the Duskypurple Skate (20.31), but has a distinctive dorsal pattern of white blotches (rather than being uniformly brownish or bluish grey).

MAGELLAN SKATE

20.29

Bathyraja magellanica (Philippi, 1902)

DD

IDENTIFICATION. Medium-sized skate with a largely smooth, heart-shaped to rhombic disc, short snout, medium-size eyes, complete thorn pattern (orbital, shoulder, and median thorns extending from nuchal region onto tail), and marbled dorsal colour pattern. Disc anterior margins convex, apices broadly rounded. Snout soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to its tip; length 2.5–3.5 times orbit length; interorbital space equal to or slightly larger than orbit length. Mouth rather broad, nasal flaps broadly lobed; tooth rows in upper jaw 28–32. Upper disc with complete thorn pattern, with large individual orbital, nape, mid-shoulder and shoulder thorns; also a median row of 26–32 strong thorns from behind shoulder girdle to first dorsal fin. Dorsal disc prickly in juveniles, becoming smooth over pectoral fins in adults; undersurface smooth. Tail broad based, robust, shorter than body length to cloaca; 2 small dorsal fins at extreme rear of tail, bases separated with a thorn in interspace. Pelvic fin weakly notched, posterior lobe enlarged; clasper robust. Pectoral-fin radials 79–90. Abdominal vertebrae 30–36, predorsal tail vertebrae 70–81.

COLOUR. Dorsal surface greyish to greyish brown with marbled pattern of small dark spots and larger pale blotches and streaks; often with large irregularly shaped pectoral markings (dark inner streaks surrounded by dark border); snout pale beside dark rostral cartilage. Undersurface mainly white; dark blotches and spots on tail tip, and along posterior disc and pelvic-fin margins.

SIZE. Attains ~105 cm TL; matures at ~58 cm TL; smallest juvenile 14 cm TL.

HABITAT AND BIOLOGY. South-East Pacific (off Chile) and South-West Atlantic (Argentina and Falkland Islands). Demersal, on continental shelf from well inshore to 150 m depths, occasionally to 600 m. Diet consists mainly of small crustaceans, also polychaetes and small bony fishes.

SIMILAR SPECIES. Off southern South America, only the Patagonian Skate (20.27) also has a complete pattern of dorsal thorns, but the Magellan Skate's skin is more prickly and thorny and has a less strongly ornamented colour pattern.

PACIFIC BUTTERFLY SKATE

20.30

Bathyraja mariposa Stevenson, Orr, Hoff & McEachran, 2004

DD

IDENTIFICATION. Medium-sized skate with a broad, heart-shaped or rhombic disc densely covered with fine denticles, no thorns on disc, tail thorns weak or obsolete, irregular yellowish pectoral marking, and densely covered above with dark spots and yellowish blotches. Disc 1.2–1.3 times broader than long; anterior margins weakly undulate in females, more so in adult males; apices evenly rounded. Snout rather broad with a minute blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length ~3.2–3.5 times orbit length; interorbital space usually slightly larger than orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps lobed; tooth rows in upper jaw 21–31. Up to 15 greatly reduced thorns on mid-line of tail when present (often absent). Upper surface (including centres of pectoral fins) uniformly covered with granular denticles; undersurface uniformly smooth. Tail flattened, tapering to apex, slightly longer than precloacal length; lateral folds restricted to posterior half of tail; 2 small dorsal fins at rear of tail barely separated, procaudal length 11–14% TL; caudal-fin upper lobe well developed. Pelvic fin with a weak notch, anterior lobe short; clasper rather slender, tip narrowly rounded. Pectoral-fin radials 76–80. Predorsal vertebrae ~96–101; abdominal vertebrae 31–34, predorsal tail vertebrae 65–72.

COLOUR. Brownish to greenish brown with many dark brown to black spots and larger yellowish brown blotches over upper disc and tail; pectoral markings present as large yellowish blotches, edges often indistinct. Ventral surface predominantly white; hind margins of pectoral and pelvic fins dusky; tail with a dark median stripe; sensory pores not visible.

SIZE. Attains at least 76 cm TL. Males mature at ~70 cm TL, females probably larger.

HABITAT AND BIOLOGY. North Pacific; Bering Sea. Demersal on insular shelves and slopes at 90–455 m depths. Life history unknown.

SIMILAR SPECIES. Resembles the Okhotsk Skate (20.58), but has a rougher disc and more complex dorsal colour pattern.

DUSKYPURPLE SKATE

20.31

Bathyraja matsubarai (Ishiyama, 1952)

DD

IDENTIFICATION. Large skate with an oval to rhombic disc, short and rather broad snout, uniformly granular dorsal disc in young (largely naked in adults), 2–5 nuchal thorns indistinct in young (larger and well separated from median series in adults), small and widely separated eyes, and disc reddish brown to purplish above with dark undersurface. Disc anterior margins weakly undulate; apices broadly to narrowly rounded. Snout with small blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length 3.2–3.8 times orbit length; interorbital space up to twice orbit length; anterior pectoral radials extending to nearly snout tip. Mouth very broad, nasal flaps broadly lobed; tooth rows in upper jaw 25–26. Thorns absent from snout, orbits and shoulders; 22–37 well-developed, regularly arranged thorns in median row on posterior disc and tail. Denticles in adult confined to snout, anterior margins of disc, and in narrow band along mid-disc and tail; undersurface entirely smooth. Tail slender, almost rounded in cross-section, tapering to apex, longer than disc length; lateral folds restricted to posterior half of tail; 2 small dorsal fins at rear of tail, barely separated; caudal fin short. Pelvic fin with moderate notch, anterior lobe short and broad; clasper broad, tip rounded. Pectoral-fin radials 75–77. Predorsal vertebrae 101–107; abdominal vertebrae 30–36, predorsal tail vertebrae 71–77.

COLOUR. Upper surface reddish brown to dark purplish, noticeably darker along mid-disc and tail. Ventral surface of disc uniformly dark, greyish; usually white on mouth and cloaca; sensory pores not marked black.

SIZE. Attains ~126 cm TL. Males mature at 82–108 cm TL, females slightly larger; egg cases 9–11 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off eastern Japan, but possibly more wide-ranging. Demersal on insular slopes at ~120–2000 m depths, mainly 550–1300 m. Bycatch of trawl fishery for halibut and rockfishes.

SIMILAR SPECIES. Belongs to a small group of North Pacific skates with a wide interorbital space, and ventral disc smooth and dark. The Whiteblotched Skate (20.28) is similar but is richly covered with white markings (rather than being plain).

DARKBELLY SKATE

20.32

Bathyraja meridionalis Stehmann, 1987

DD

IDENTIFICATION. Large, heavy-bodied skate with a rhombic disc, short snout (slightly longer than half head length), upper disc and tail very spiny, no thorns on head, almost continuous median row from nape to dorsal fins, and both upper and lower surfaces dark. Disc anterior margins undulate, concave in adult males; apices narrowly rounded to bluntly angular. Snout broad with a small bluntly pointed tip; soft and flexible vertically due to very delicate rostral cartilage; length 2.5–4 times orbit length, interorbital space 1.2–1.3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth very narrow, nasal flaps broadly lobed; tooth rows in upper jaw 26–32. Snout, orbital and shoulder thorns absent; 1–3 nuchal, 1 mid-scapular, and thorns in median row on posterior disc (5–10) and tail (19–36). Upper disc loosely covered with rough dermal denticles, much more densely set on back of trunk and sides of tail; undersurface entirely smooth (except anterior edges of tail). Tail depressed, tapering evenly to apex, slightly longer than disc; lateral folds extending almost full length of tail; 2 small dorsal fins at rear of tail separated slightly; caudal fin rudimentary. Pelvic fin moderately notched, anterior lobe short. Pectoral-fin radials 90–97. Abdominal vertebrae ~36 (possibly 32–41), predorsal tail vertebrae 78–84.

COLOUR. Plain brown to blackish brown above, thorns milky white; adults often paler than young. Ventrally, dark brown (somewhat paler in adults); oronasal region, gill slits, and tips of anterior pelvic-fin lobes usually whitish.

SIZE. Attains ~150 cm TL. Males mature at 132–142 cm TL, females ~140 cm TL.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; patchy, off southern Chile to Argentina, including South Georgia (probably more widespread in sub-Antarctic). Demersal on continental and insular slopes at ~65–2240 m depths. Adults probably feed on small bony fishes. Regular bycatch when longlining for Patagonian Toothfish at Falkland Islands.

SIMILAR SPECIES. The Multispine (20.35) and Atlantic Butterfly (20.41) Skates are both paler ventrally (never totally dark).

FINESPINE SKATE

20.33

Bathyraja microtrachys (Osburn & Nichols, 1916)

LC

IDENTIFICATION. Medium-sized skate with an angular rhombic disc, broad snout, skin densely covered with fine prickly denticles, no nuchal or shoulder thorns, no orbital thorns, tail slightly shorter than disc width, brownish above, and undersurface of disc white centrally with broad greyish brown margin. Disc 1.1–1.2 times wider than long; anterior margins almost straight, apices rather broadly rounded. Snout with a blunt fleshy tip, not extended; soft and flexible vertically due to very delicate rostral cartilage; length 3.3–3.8 times orbit length; interorbital space 1.2–1.7 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth and nasal flaps broad; tooth rows in upper jaw 29–32. Thorns absent from disc; single row of 22–23 evenly spaced, median thorns along predorsal tail, thorns short and conical with broad bases. Upper disc and tail uniformly covered with denticles; undersurface smooth. Tail thickened, slightly depressed, tapering to apex, slightly longer than precloacal length; lateral folds well developed; 2 low dorsal fins at rear of tail usually separated slightly with small interdorsal thorn, procaudal length subequal to snout length; caudal fin low. Pelvic fin deeply notched, anterior lobe shorter than posterior lobe, adult clasper unknown. Predorsal tail vertebrae 69–70.

COLOUR. Dorsal surface uniformly medium brown. Ventral surface white around mouth, central disc and bases of anterior pelvic-fin lobes; tail and outer margin of disc greyish brown (width of dark band exceeding snout length across pectoral fins); sensory pores not marked black.

SIZE. Attains at least 70 cm TL. Females mature from ~60 cm TL; young hatch at ~17 cm TL.

HABITAT AND BIOLOGY. North-East Pacific; Washington State to southern California (USA). Demersal and common on lower continental slopes and abyssal plains at 1995–3100 m depths.

SIMILAR SPECIES. Once considered to be identical with the Roughtail Skate (20.55), but a distinctive white ventral band from the snout to the pelvic fins in the Finespine Skate is unique within skates of the North Pacific.

SMALLTHORN SKATE 20.34

Bathyraja minispinosa Ishiyama & Ishihara, 1977

LC

IDENTIFICATION. Medium-sized skate with a heart-shaped or rhombic disc, denticles widespread over upper disc in young (smooth patches in adults), no scapular or orbital thorns, median thorn row discontinuous, both surfaces darkish anteriorly, and white mask-like marking on orbital region. Disc anterior margins most undulate in adult males, apices narrowly rounded. Snout soft and flexible vertically due to very delicate rostral cartilage; length 3.5–4.7 times orbit length; interorbital space 1–1.3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps distinctly lobed; tooth rows in upper jaw 28–34. Row of 1–4 nuchal thorns and median row of 19–26 tail thorns discontinuous over belly; thorns large, scute-like and evenly spaced. Fine denticles cover most of disc in young; absent from mid-pectoral fins in adult males; undersurface entirely smooth, apart from snout tip. Tail rather robust, rounded in cross-section, tapering to apex, 1.1–1.2 times longer than precloacal length; lateral folds confined to posterior tail; 2 tall dorsal fins, barely separated; caudal fin rudimentary. Pelvic fin with moderate notch, anterior lobe short and broad; clasper rather broad. Pectoral-fin radials ~75. Predorsal vertebrae usually 101–103; abdominal vertebrae 29–34, predorsal tail vertebrae 65–76.

COLOUR. Upper surface dark brown to bluish with prominent white marking around eyes and spiracles. Ventral surface brownish anteriorly; chin, tail and posterior disc including outer margins of pectoral fins usually white or pale grey; sensory pores not marked black.

SIZE. Attains ~90 cm TL. Males mature from 64–67 cm TL, females 64–69 cm TL; egg cases 7–8 cm long.

HABITAT AND BIOLOGY. North Pacific; Arctic rim, northern Japan to Alaska (USA). Demersal on sandy or gravelly bottoms of continental and insular shelves and slopes at 150–1420 m depths, mainly in 300–750 m. Feeds on bony fishes, crabs and cephalopods.

SIMILAR SPECIES. A distinctive white marking in the Smallthorn Skate, resembling a mask around the eyes, is unique within the genus.

MULTISPINE SKATE

20.35

Bathyraja multispinis (Norman, 1937)

NT

IDENTIFICATION. Large skate with a broad rhombic disc, rather short snout, small eyes, shoulder thorn, no orbital or rostral thorns, many thorns in median row (exceeding 35) from nape to dorsal fins, and reticulate pattern on dorsal surface. Disc anterior margins undulate, apices narrowly rounded. Snout bluntly angled with small tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip; length ~3.5 times orbit length; interorbital space more than 1.5 times orbit length. Mouth rather broad, nasal flaps broadly lobed; tooth rows in upper jaw 33–34. Upper disc with single shoulder thorn; median row of 36–45 strong thorns from nape to first dorsal fin, 15–17 before tail. Skin largely smooth; scattered denticles on head, anterior and posterior disc margins, and flanking median thorn row on trunk; sides of tail densely prickly; undersurface entirely smooth. Tail broad based, robust, subequal to precloacal length; 2 small dorsal fins at rear of tail narrowly separated, a small thorn in interspace. Pelvic fin weakly notched, posterior lobe large; clasper long, slender. Pectoral-fin radials 92–95. Abdominal vertebrae 35–40, predorsal tail vertebrae 71–86.

COLOUR. Dorsal surface greyish brown, with reticulate pattern of light and dark spots and lines; disc with large dark pectoral ocellus and usually many smaller markings (pale circular spots with dark margins and similar dark markings with pale margins). Undersurface white, often with dusky markings along posterior disc margins and pelvic fins, at cloaca, and over tail.

SIZE. Attains ~126 cm TL; matures at ~97 cm TL.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; from southern Chile to Brazil, including Falkland Islands. Demersal on continental and insular shelves and slopes at 70–740 m depths. Feeds largely on crustaceans and fishes.

SIMILAR SPECIES. The Darkbelly (20.32) and Atlantic Butterfly (20.41) Skates, which lack shoulder thorns and a reticulate colour pattern (both plain coloured), are much darker on the ventral surface than the Multispine Skate.

MURRAY'S SKATE 20.36

Bathyraja murrayi (Günther, 1880)

NT

IDENTIFICATION. Medium-sized skate with a broad rhombic disc, rather short snout, large eyes, shoulder and nuchal thorns, usually 2 orbital thorns, median thorns discontinuous between nuchal region and tail, and subtle spotted dorsal coloration. Disc anterior margins undulate, without a deep concavity; apices rather narrowly rounded; snout bluntly angled with small apical tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip; length ~2.2 times orbit length; interorbital space subequal to orbit length. Mouth rather narrow, nasal flaps broadly lobed. Upper disc usually with a single shoulder thorn, 2–4 nuchal thorns; median row of up to 26 thorns on tail (often lost with age), fewer in adults than young. Coarse star-shaped dermal denticles scattered over dorsal disc in young and females, surface largely smooth on pelvic fins and over central half of disc in adult males; undersurface entirely smooth. Tail moderately robust, subequal to precloacal length in adults but longer in juveniles; 2 small dorsal fins at rear of tail, barely separated; lateral folds extending along entire tail. Pelvic fin weakly notched, posterior lobe large; clasper long and slender.

COLOUR. Dorsal surface variable, plain brownish or with diffuse light and dark spots and/or reticulations; adults usually with a large, prominent yellowish ocellus on each side in adults. Undersurface usually entirely white, but sometimes disc with dusky edges and blotches, and a dark tail.

SIZE. Attains ~60 cm TL; matures at ~45 cm TL.

HABITAT AND BIOLOGY. Southern Ocean; off Kerguelen and Heard Islands. Demersal on insular shelves and slopes at 20–800 m depths. Little known, but caught as bycatch of trawl fishery for Antarctic toothfish and icefishes.

SIMILAR SPECIES. Distinctive skate and common at Kerguelen and Heard Islands; appears to belong to a species complex. Differs from Eaton's Skate (20.14) and McCain's Skate (20.26) in having a much rougher upper disc, covered with coarse spinules and thornlets.

NOTORO SKATE

20.37

Bathyraja notoroensis Ishiyama & Ishihara, 1977

NE

IDENTIFICATION. Large skate with a broad rhombic disc, short and rather broad snout, granular dorsal disc with mid-pectoral fins naked, 2–5 large nuchal thorns well separated from lumbar series in adults, small and widely separated eyes, and disc greyish brown above with dark undersurface. Disc anterior margins weakly undulate; apices narrowly rounded. Snout with small blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length 3.2–3.8 times orbit length; interorbital space almost twice orbit length; anterior pectoral radials extending to nearly snout tip. Mouth very broad, nasal flaps broadly lobed; tooth rows in upper jaw 18–30. Thorns absent from snout, orbit and shoulder; 24–30 well-developed, regularly arranged thorns in median row on posterior disc and tail. Denticles in adults covering disc, but absent on snout tip, anterior pelvic-fin lobes and mid-pectoral fins; well-defined narrow band extending along mid-disc and tail; undersurface entirely smooth. Tail slender, almost rounded in cross-section, tapering to apex, longer than disc length; lateral folds restricted to posterior half of tail; 2 small dorsal fins at rear of tail, barely separated; caudal fin short. Pelvic fin with moderate notch, anterior lobe short and broad; clasper short and broad, tip rounded. Predorsal vertebrae 110; abdominal vertebrae 38.

COLOUR. Upper surface uniformly greyish brown. Ventral surface of disc dark, greyish but paler than upper surface; chin, cloaca and tip of anterior pelvic-fin lobes white; sensory pores whitish.

SIZE. Attains ~104 cm TL. Males and females mature at ~55 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; off northern Japan. Demersal, known from insular slopes at ~600 m depths. Poorly known.

SIMILAR SPECIES. Very similar to the Duskypurple Skate (20.31), which has a more reddish brown disc (rather than greyish brown) and a longer clasper. The Notoro Skate's validity needs to be confirmed as it is most likely a synonym of that species.

PACIFIC BLONDE SKATE 20.38

Bathyraja pacifica Last, Stewart & Séret, 2016

NE

IDENTIFICATION. Large skate with a smooth and extremely flattened, angular rhombic disc, broadly triangular snout, eyes narrowly separated, mouth small, no denticles or thorns (apart from median row on tail and alar patch in adult males), and coloration uniformly white above and below. Disc anterior margins straight, then weakly concave behind orbit; apices narrowly rounded. Snout pointed, small fleshy lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length ~7.1 times orbit length, interorbital space ~1.8 times orbit length; anterior pectoral radials extending nearly to snout tip. Mouth much narrower than its distance from disc margin, nasal flaps strongly lobed; tooth rows in upper jaw ~29. Disc lacking thorns, alar patch well developed; ~16 large, regularly spaced thorns in median row on tail before dorsal fins, no interdorsal thorns. Upper surface almost entirely smooth, lacking noticeable denticles; undersurface entirely naked. Tail rather short, ~0.8 times precloacal length, slender, tapering to apex, fleshy; lateral folds well developed (particularly so at rear); dorsal fins small, rounded, bases joined; located near tip of tail, procaudal length ~9% TL; caudal-fin upper lobe rudimentary. Pelvic fins small, notched, anterior lobe very short in adult male; clasper very long and expanded distally. Pectoral-fin radials ~84. Predorsal vertebrae ~105; abdominal vertebrae ~34, predorsal tail vertebrae ~71.

COLOUR. Upper surface uniformly white (becoming pinkish after capture). Ventral surface also entirely white; sensory pores not marked black.

SIZE. Known from a single adult male, 122 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; west Norfolk Ridge, off New Zealand, and possibly further south. Demersal on deep insular slopes at ~1760–1790 m depths. Life history unknown.

SIMILAR SPECIES. Occurs in northern part of the South-West Pacific with the similarly shaped Domino Skate (20.23). Both species have a pale dorsal surface, but the Domino Skate is uniformly black ventrally (rather than white).

PALLID SKATE

20.39

Bathyraja pallida (Forster, 1967)

LC

IDENTIFICATION. Very large skate with a thickened rhombic disc, broadly elongate snout, skin of upper disc largely smooth and entirely lacking thorns, tail much shorter than disc in adults, and disc uniformly pale dorsally and darker brown underneath. Disc with very thick trunk; margin undulate anteriorly, more concave in adult males; apices bluntly angular. Snout pointed, soft and flexible vertically due to very delicate rostral cartilage; length ~4–6 times orbit length and about half head length, interorbital space 1.5–2.5 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps broadly lobed; tooth rows in upper jaw 24–31. No thorns on central disc or near orbit; 16–21 blunt thorns in median row on tail before dorsal fins, interdorsal thorn usually present. Upper surface largely smooth, denticles confined to a narrow patch on central anterior margins of disc, and covering most of dorsal tail; undersurface entirely smooth, apart from a few loosely scattered denticles on tail. Tail broad based but tapering quickly to apex, firm, almost rounded in cross-section; lateral folds weak; 2 small dorsal fins at rear of tail separated slightly; caudal fin short in adults, longer in young. Pelvic fin weakly notched, anterior lobe very short; clasper very long and slender.

COLOUR. Upper surface plain pale greyish or white. Ventral surface brownish, often with white blotches along its mid-line; sensory pores not marked black.

SIZE. Attains at least 162 cm TL. Males exceeding 144 cm TL were mature; egg cases ~30 cm long.

HABITAT AND BIOLOGY. North Atlantic; mid-Atlantic Ridge to France, patchy. Probably benthic from lower continental and insular slopes to abyss at 1870–3280 m depths and beyond. Adults feed mainly on squids and small bony fishes, juveniles on crustaceans and polychaetes.

SIMILAR SPECIES. The Spinytail Skate (20.51) occurs further north in the Atlantic Ocean and differs from the Pallid Skate in having a rougher dorsal disc surface, more tail thorns, and a paler undersurface. Disc shape also resembles the more widely distributed Richardson's Skate (20.44).

PANTHER SKATE

20.40

Bathyraja panthera Orr, Stevenson, Hoff, Spies & McEachran, 2011

LC

IDENTIFICATION. Large, heavy-bodied skate with broad rhombic disc, short snout, 1–2 shoulder thorns, continuous row of median thorns from nape onto tail, denticle band on mid-disc obvious and continuing along sides of tail, lateral folds originating near tail base, and variably vermiculated with black spots and yellowish blotches. Disc 1.2–1.3 times wider than long; anterior margins undulate in females and young, more so in adult males; apices rather broadly rounded. Snout with minute lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length 2.2–4.9 times orbit length; interorbital space 0.6–1.3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth rather small, nasal flaps broadly lobed; tooth rows in upper jaw 24–31. Thorns on upper disc well developed; 31–42 in median row from nuchal region to first dorsal fin. Dorsal denticles confined mainly to orbital region, anterior disc margins and longitudinal band on mid-disc; tail covered with small prickles laterally, but skin smooth beside tail thorns; undersurface uniformly smooth. Tail moderately elongate, flattened, tapering to apex; small dorsal fins, procaudal length 9–15% TL; caudal-fin upper lobe rather well developed. Pelvic fin with moderate notch, anterior lobe moderately elongate; clasper robust. Pectoral-fin radials 82–90. Predorsal vertebrae 118–129; abdominal vertebrae 35–40, predorsal tail vertebrae 81–94.

COLOUR. Upper surface yellowish to greenish brown, variably vermiculated and pectoral markings not well-defined; males pale with dark markings, females darker with yellowish spots, streaks and blotches. Ventral surface white, dusky patches often around cloaca and along tail mid-line; sensory pores not marked black.

SIZE. Attains ~139 cm TL; egg cases 11–13 cm long.

HABITAT AND BIOLOGY. North Pacific; Bering Sea, off western Aleutian Islands and Petrel Bank (Alaska). Demersal on insular shelves and upper slopes at 50–260 m depths, possibly deeper to 395 m.

SIMILAR SPECIES. Belongs to a small group of similar northern Pacific deepwater skates that includes the Alaska (20.42), Hokkaido (20.48) and Golden (20.49) Skates.

ATLANTIC BUTTERFLY SKATE 20.41

Bathyraja papilionifera Stehmann, 1985

DD

IDENTIFICATION. Large, heavy-bodied skate with an angular rhombic disc, moderately elongate snout, single discontinuous row of median thorns from nape to tail (but no other thorns), and plain brownish above and sometimes white-spotted. Disc ~1.1 times length; anterior margins almost straight, apices narrowly rounded to abruptly angular. Snout bluntly angled with short and broad lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length 3.5–4.5 times orbit length; interorbital space 1–1.2 times orbit length. Mouth rather narrow; tooth rows in upper jaw 28–38. Thorn present on each shoulder of small juveniles, otherwise with only 3–4 large median thorns on nape and mid-shoulder of disc; median row of 20–22 strong and evenly spaced thorns on tail before first dorsal fin. Skin of upper surface with coarse dermal denticles on head, along disc margins, on back of trunk and sides of tail; undersurface smooth. Tail firm, length subequal to precloacal length; 2 small dorsal fins near rear of tail, narrowly separated, usually with thorn in interspace, procaudal length shorter than 3/4 snout length. Pelvic fin moderately notched, anterior lobe large. Pectoral-fin radials 88–89. Abdominal vertebrae 31–39, predorsal tail vertebrae 71–79.

COLOUR. Upper surface plain brownish or with small faint pale spots on disc when half-grown. Ventrally, whitish centrally; outer corners and posterior margins of disc, and pelvic-fin margins, broadly dark-edged; tail dark with white tip; young with large butterfly-shaped blotch near cloaca.

SIZE. Attains ~150 cm TL. Males and females mature at ~130 and ~122 cm TL respectively.

HABITAT AND BIOLOGY. South-West Atlantic; Uruguay to southern Argentina, including Falkland Islands (possibly also southern Chile). Demersal on upper and mid-continental and insular slopes at 635–1615 m depths. Bycatch of toothfish fishery.

SIMILAR SPECIES. The Multispine Skate (20.35) has a more uniformly pale undersurface, and the Darkbelly Skate (20.32) is darker ventrally and has a continuous median thorn row extending from the nape to the first dorsal fin.

ALASKA SKATE

20.42

Bathyraja parmifera (Bean, 1881)

LC

IDENTIFICATION. Large, heavy-bodied skate with a broad rhombic disc, short snout, 1–3 well-developed shoulder thorns, median thorn row usually discontinuous, denticle band on mid-disc wide and extending along sides of tail, lateral folds originating near tail base, and uniformly brown dorsally. Disc 1.1–1.3 times wider than long; anterior margins distinctly undulate in both females and adult males; apices rather narrowly rounded. Snout with minute lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length 2.8–5.9 times orbit length; interorbital space 0.6–1.1 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth rather small, nasal flaps broadly lobed; tooth rows in upper jaw 22–33. Median thorns prominent, 19–36 from nape to first dorsal fin. Dorsal denticles large, widely spaced, confined mainly to orbital region, anterior pectoral-fin margins and median band; sides of tail covered with similar prickles but skin smooth beside tail thorns; undersurface uniformly smooth. Tail length 0.8–1.2 times precloacal length; flattened slightly, tapering to apex; small upright dorsal fins, procaudal length 9–14% TL; caudal fin small. Pelvic fin moderately notched, anterior lobe moderately elongate; clasper rather robust. Pectoral-fin radials 81–89. Predorsal vertebrae 118–128; abdominal vertebrae 32–40, predorsal tail vertebrae 82–89.

COLOUR. Upper surface almost uniformly dark brown, often with vague blackish spots and yellow-blotched pectoral marking. Ventral surface white, usually with dusky patches around mouth, gill slits, cloaca and on tail; sensory pores not marked black.

SIZE. Attains at least 115 cm TL, but reported to 135 cm TL. Matures at 80–95 cm TL; egg cases 11–15 cm long.

HABITAT AND BIOLOGY. North Pacific; Arctic rim, Bering Sea to Alaska (USA). Demersal, mainly on insular and continental shelves and slopes at 15–400 m depths. Most common skate in eastern Bering Sea.

SIMILAR SPECIES. The very similar Hokkaido Skate (20.48) and the Alaska Skate may be two forms of the same species. The Hokkaido Skate appears to have less widely separated dorsal fins, and more thorns and vertebrae.

PERUVIAN SKATE

20.43

Bathyraja peruana McEachran & Miyake, 1984

DD

IDENTIFICATION. Large, heavy-bodied skate with a broad rhombic disc, moderately short snout, small eyes, thorns absent from disc (apart from alar thorns of adult male), and plain dark brown or greyish above and below. Disc 1.2–1.3 times length; anterior margins straight or weakly undulate, apices narrowly or abruptly rounded. Snout broad, bluntly angled, small lobe at tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to tip; length ~2.6–2.7 times orbit length; interorbital space subequal to orbit length. Mouth rather narrow; tooth rows in upper jaw 33–36. No thorns on upper disc; confined to median row on tail; 18–26 evenly spaced thorns before first dorsal fin. Skin of upper disc and tail covered with fine denticles; more densely set on head, anterior disc margins, and along back of trunk and sides of tail (sparse on disc over central pectoral fins); smooth ventrally. Tail slender, firm, slightly longer than precloacal length; 2 small dorsal fins narrowly separated, without thorn in interspace, located at rear of tail (procaudal length short, subequal to snout length). Pelvic fin notched, anterior lobe broad and short. Caudal fin minute. Pectoral-fin radials 77–82. Predorsal vertebrae 101–106; abdominal vertebrae 33–35, predorsal tail vertebrae 67–73.

COLOUR. Dorsal surface usually plain dark brownish (sometimes greyish), thorns white; young with light and dark speckles and blotches. Ventral surface similarly dark brown; mouth white.

SIZE. Attains at least 105 cm TL, supposedly mature at this size.

HABITAT AND BIOLOGY. South-East Pacific; off Ecuador, Peru and northern Chile. Demersal on South American continental slope at 245–1060 m depths, mainly deeper than 600 m. Egg cases unknown and no data on diet.

SIMILAR SPECIES. The Whitebelly Skate (20.98) is largely smooth on the upper disc but the median thorn row extends forward onto the disc. Other deepwater species of *Bathyraja* from the Eastern Pacific have prickly ventral surfaces, but compared to members of this genus from the North Pacific are not well known.

RICHARDSON'S SKATE

20.44

Bathyraja richardsoni (Garrick, 1961)

LC

IDENTIFICATION. Very large, heavy-bodied skate with a rhombic disc, broadly elongate snout (almost half head length), granular upper disc entirely lacking thorns, eyes very widely separated and mouth extremely broad, tail much shorter than disc, and uniformly greyish brown on both surfaces. Disc trunk very thick; margin deeply concave behind spiracles in adult males; apices bluntly angular. Snout pointed and fleshy, soft and flexible vertically due to very delicate rostral cartilage; length 4.5–4.8 times orbit length, interorbital space ~2.9–3.1 times orbit length; eyes positioned relatively close to edge of disc; anterior pectoral radials obscure near snout tip. Mouth large, nasal flaps weakly lobed; tooth rows in upper jaw 21–39. No thorns on central disc or near orbit; 15–20 blunt thorns in median row on tail before dorsal fins, no interdorsal thorns. Upper surface almost entirely covered with coarse denticles; undersurface variably granular, denticles mostly present on snout, abdomen and tail. Tail very short and slender, tapering to apex, almost rounded in cross-section; lateral folds narrow; 2 small dorsal fins at rear of tail barely separated; caudal fin minute. Pelvic fin weakly notched, anterior lobe very short; clasper very long and bulbous distally. Pectoral-fin radials 81–88. Abdominal vertebrae 34–39, predorsal tail vertebrae 64–71.

COLOUR. Upper surface plain, pale to dark greyish brown. Ventral surface similar, but with white areas on mid-disc, in pelvic region and over tail; sensory pores not marked black.

SIZE. Attains at least 175 cm TL. Males mature by 157 cm TL. Egg cases ~20 cm long; young hatch at 18–25 cm TL.

HABITAT AND BIOLOGY. North Atlantic and South Pacific, but probably cosmopolitan. Benthopelagic on continental and insular slopes, submarine rises and abyssal plains at 500–3055 m depths. Feeds mainly on crustaceans and bony fishes.

SIMILAR SPECIES. A robust, largely thornless disc, with very widely separated eyes located near the disc margin, distinguish this species from all other *Bathyraja* skates, apart from Cristina's Skate (20.56) from the Western Indian Ocean.

CUPHEAD SKATE

20.45

Bathyraja scaphiops (Norman, 1937)

NT

IDENTIFICATION. Medium-sized skate with an angular rhombic disc, elongate and rather broadly pointed snout (longer than half head length), median thorns confined to tail, and upper surface brownish and darker than lower surface. Disc width ~1.2 times length; anterior margins undulate, more so in adult males; apices bluntly angular. Snout tip pointed; soft and flexible vertically due to very delicate rostral cartilage; length 3.4–5 times orbit length, interorbital space 0.8–1 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth rather narrow, nasal flaps broadly lobed; tooth rows in upper jaw 30–34. No thorns on disc; tail with single median row of 13–21 evenly spaced thorns; small interdorsal thorn. Denticles confined to anterior disc margins and outer corners; broad band on mid-disc extends along sides of tail; undersurface smooth. Tail depressed, tapering evenly to apex, slightly shorter than precloacal length; lateral folds extend almost full length of tail; 2 small dorsal fins separated slightly, procaudal length shorter than snout length; caudal fin very small. Pelvic fin notched, anterior lobe short; claspers very slender. Pectoral-fin radials 89–91. Abdominal vertebrae 31–34, predorsal tail vertebrae 70–71.

COLOUR. Upper surface reddish brown to greyish brown; often with indistinct pale spots and white pectoral marking in adults; snout transparent with delicate rostral cartilage clearly visible. Undersurface mainly white; undersurface of tail and outer disc often with brown spots and blotches.

SIZE. Attains ~117 cm TL. Males mature at ~74 cm TL, smallest known specimen 21 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; southern Brazil to Patagonian Argentina, including Falkland Islands. Demersal on continental and insular shelves and slopes at 30–925 m depths; most abundant over the central shelf at 105–160 m depths. Feeds on small crustaceans when young, adults mainly on fishes.

SIMILAR SPECIES. No other *Bathyraja* species in the South-West Atlantic has such a long and markedly pointed snout. Long-snouted *Zearaja* skates have radials of the pectoral-fin skeleton falling well short of the snout tip and their rostral cartilages are broad and stiff.

WHITEMOUTH SKATE 20.46

Bathyraja schroederi (Krefft, 1968)

DD

IDENTIFICATION. Large skate with a broad rhombic disc, broad and blunt snout (about half head length), thorns confined to short median row on tail (ending well before first dorsal fin), and greyish upper surface as dark as or paler than undersurface. Disc width ~1.3 times length; anterior margins weakly undulate; apices broadly rounded. Snout moderately short, blunt at tip; soft and flexible vertically due to very delicate rostral cartilage; length ~4.3 times orbit length, interorbital space ~1.6 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth rather narrow, nasal flaps broadly lobed; tooth rows in upper jaw 21–32. No thorns on upper disc; short median row of small thorns on tail (12–14 in juveniles, 19–30 in adults), row ending well before first dorsal fin (no interdorsal thorn). Dorsal denticles extensive in juveniles, becoming confined to disc margins, mid-disc and tail in adults; undersurface smooth (prickles on tail edges in young). Tail slender, very narrow posteriorly, distinctly longer than precloacal length; lateral folds extending almost full length of tail; 2 small dorsal fins narrowly separated; caudal fin small. Pelvic fin notched, anterior lobe short, claspers very slender with bulbous tips. Pectoral-fin radials 81–102. Abdominal vertebrae 30–42, predorsal tail vertebrae 75–87.

COLOUR. Upper surface plain greyish to greyish brown, blackish brown in small young; anterior pelvic-fin lobe black. Ventrally brownish black and paler around mouth, gill slits, cloaca and tips of anterior pelvic lobes.

SIZE. Attains ~130 cm TL; a male 113 cm TL was mature.

HABITAT AND BIOLOGY. South-East Pacific and South-West Atlantic; patchy, Chile, Uruguay, Falkland Islands, and possibly Brazil. Demersal on continental and insular slope and abyssal plain at 800–2380 m depths.

SIMILAR SPECIES. The Darkbelly Skate (20.32) has prominent median thorns that extend from the nape to the first dorsal fin; other *Bathyraja* in the South-West Atlantic have a totally or largely white undersurface.

NARROWNOSE SKATE

20.47

Bathyraja shuntovi Dolganov, 1985

DD

IDENTIFICATION. Large, thin-bodied skate with a broad rhombic disc, very long triangular snout, narrow mouth and interorbital space, short tail, smooth skin in adults, and largely pale on both upper and lower surfaces. Disc firm, rhombic; anterior margins initially straight then deeply concave near its apex, apices narrowly rounded. Snout very acute, delicate and flexible vertically due to very thin rostral cartilage; length up to 10 times orbit length in adults; interorbital space ~0.9–1.3 times orbit length; anterior pectoral radials extending nearly to snout tip. Mouth small, nasal flaps narrowly lobed; tooth rows in upper jaw ~34. No thorns on disc apart from narrow alar thorn patches in adult males; median row of 19–23 very small thorns along tail to first dorsal fin. Upper surface of disc sparsely covered with denticles in young; skin becoming entirely smooth in adults. Tail tapering evenly, shorter than disc length; 2 small dorsal fins at rear of tail barely separated; caudal fin minute. Pelvic fins small, very strongly notched, anterior lobe narrow; clasper long and slender. Pectoral-fin radials ~91. Predorsal vertebrae ~114; abdominal vertebrae ~35, predorsal tail vertebrae ~79.

COLOUR. Upper surface pale greyish pink, greyish or greyish blue; translucent to white on central snout, eyes blue; anterior pelvic-fin lobe and clasper dark. Ventral surface of disc largely whitish or pale pink; tail, and outer edges of pectoral and pelvic fins brownish, often dark; sensory pores not black-edged; dorsal and caudal fins greyish.

SIZE. Attains ~140 cm TL (possibly to 175 cm TL). Males mature at ~92 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Zealand. Demersal on insular slopes at 300–1485 m depths, usually deeper than 1000 m. Life history little known. Discarded bycatch of local trawl fisheries.

SIMILAR SPECIES. A distinctive body shape with a greatly elongated and pointed, triangular snout distinguishes this species from other *Bathyraja* of the region.

HOKKAIDO SKATE

20.48

Bathyraja simoterus (Ishiyama, 1967)

NE

IDENTIFICATION. Large skate with a broad rhombic disc, short tail with lateral folds originating near its base, usually 2 shoulder thorns, nuchal thorns continuous with median row on disc and tail, central disc largely smooth with weak median denticle band, and upper surface usually plain brownish. Disc 1.1–1.4 times wider than long, its widest point slightly closer to tail than to snout; becoming more heart-shaped with anterior margins deeply concave in adult males; apices rounded. Snout rather elongate, tip broad and blunt; soft and flexible vertically due to very delicate rostral cartilage; length 2.6–3.5 times orbit length; interorbital space subequal to orbit length; anterior pectoral radials extending to nearly snout tip. Mouth rather narrow, nasal flaps broadly lobed; tooth rows in upper jaw 23–28. Thorns large, absent from orbit and snout; outermost shoulder thorn larger than innermost thorn; 33–38 thorns in median row from nuchal region to dorsal fins. Upper disc with denticles confined mainly to orbital rim, disc margin and in weak band over lumbar region; sides of tail covered with small prickles but smooth beside tail thorns; undersurface uniformly smooth. Tail length 0.8–0.9 times precloacal length; flattened slightly, tapering to apex; small dorsal fins near tail tip, procaudal length 9–11% TL; caudal fin minute. Pelvic fin notched, anterior lobe short and broad; clasper robust, tip broadly rounded. Pectoral-fin radials ~85. Predorsal vertebrae ~131; abdominal vertebrae 39–41, predorsal tail vertebrae ~90.

COLOUR. Upper surface mainly uniformly brown, often with yellowish markings; ventral surface white, usually with dusky patches around cloaca and on tail; sensory pores not marked black.

SIZE. Attains ~101 cm TL. Males mature at ~94 cm TL; egg cases ~12 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off eastern Japan. Demersal on insular shelf and slope at 95–540 m depths. Biology unknown.

SIMILAR SPECIES. May be identical to the Alaska Skate (20.42), but provisionally retained as a distinct species as their ranges appear to be widely disjunct.

GOLDEN SKATE

20.49

Bathyraja smirnovi (Soldatov & Pavlenko, 1915)

LC

IDENTIFICATION. Large, heavy-bodied skate with a broad rhombic disc, short tail with lateral folds originating near its base; 1–2 well-developed shoulder thorns, median thorns discontinuous from nape to tail, narrow band of fine denticles on mid-disc extend along sides of tail, and a plain brownish dorsal coloration. Disc 1.2–1.4 times wider than long, its widest point much closer to tail than to snout; anterior margins weakly undulate in females, more concave in adult males; apices narrowly rounded to bluntly angular. Snout broad, moderately elongate; soft and flexible vertically due to very delicate rostral cartilage; length 2.8–4.1 times orbit length; interorbital space 0.7–1.1 times orbit in adults; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 18–29. Thornlets present above orbit, on snout and along anterior margins of disc; 2–4 large nuchal thorns well separated from 20–34 regularly spaced tail thorns. Upper surface covered with fine denticles, becoming smooth over mid-pectoral fins in adults; undersurface uniformly smooth. Tail length 0.7–1.1 times precloacal length; flattened slightly, tapering evenly to its tip; small dorsal fins located near tail tip, procaudal length 8–13% TL; caudal fin minute. Pelvic fin weakly notched; clasper rather broad, tip rounded. Pectoral-fin radials 82–92. Predorsal vertebrae ~118–127; abdominal vertebrae 31–38, predorsal tail vertebrae 83–96.

COLOUR. Upper surface uniformly golden to dark brown; ventral surface white with dusky patches on cloaca and tail; sensory pores not marked black.

SIZE. Attains ~116 cm TL. Males and females mature at ~100 and ~92 cm TL respectively. Egg cases 12–15 cm long; young hatch at ~22 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Sea of Japan and Sea of Okhotsk (Russia). Demersal, continental and insular shelves and slopes at 100–1125 m depths. Feeds mostly on crustaceans, octopuses and small bony fishes.

SIMILAR SPECIES. Differs from the co-occurring Hokkaido Skate (20.48) in having a discontinuous row of denticles between the nape and tail.

SOFTNOSE SKATE

20.50

Bathyraja smithii (Müller & Henle, 1841)

DD

IDENTIFICATION. Large skate with a broad rhombic disc, moderately elongate snout, upper surface largely rough apart from central and posterior disc, disc thorns present in young but absent in adults, tail shorter than 60% of disc width and with thorns in closely packed single row, and disc uniformly greyish brown above and paler below. Disc 1.3–1.4 times wider than long, its widest point slightly closer to tail than to snout; anterior margins undulate, more so in adult males; apices narrowly rounded. Snout with small lobe at tip, length 2.8–3.7 times orbit length, interorbital space 1.5–1.9 times orbit length in adults; soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending to snout tip. Mouth rather broad, nasal flaps lobed; tooth rows in upper jaw 23–28. Tail thorns sharp, evenly spaced, 14–19 in median row in adults. Dorsal denticles coarse, loosely set anteriorly and in well-defined longitudinal band along mid-disc; undersurface entirely smooth. Tail slender, tapering to apex, usually slightly shorter than precloacal length; lateral folds narrow, originating near middle of tail; dorsal fins low, separated slightly, procaudal length subequal to snout length; caudal fin low, long based. Pelvic fin deeply notched. Pectoral-fin radials usually 82–90. Predorsal vertebrae 104–107; abdominal vertebrae 32–37, predorsal tail vertebrae 67–74.

COLOUR. Dorsal surface uniformly pale greyish to chocolate brown. Undersurface largely white; disc anterior margins black, and posterior margins and cloaca broadly and sharply marked dark brown; tail brownish black; sensory pores not black.

SIZE. Attains ~120 cm TL. Males mature at ~95–97 cm TL, females at ~80–90 cm TL. Smallest known specimen 13 cm TL.

HABITAT AND BIOLOGY. South-East Atlantic; Namibia to South Africa, possibly also in South-West Indian Ocean. Demersal on continental slope at 250–1040 m depths. Feeds on bony fishes, prawns, octopuses and squids.

SIMILAR SPECIES. Cristina's Skate (20.56), also from the continental slope off southern Africa, has a more elongate, triangular snout, more widely separated eyes, and a darker ventral surface.

SPINYTAIL SKATE 20.51

Bathyraja spinicauda (Jensen, 1914)

NT

IDENTIFICATION. Very large, heavy-bodied skate with a rhombic disc, broadly elongate snout (length slightly longer than half head length), upper disc entirely granular but lacking thorns (apart from alar patches in adult males), tail shorter than precloacal length in adults, and plain greyish dorsally and whitish below. Disc width ~1.2 times length, trunk thick; margin undulate anteriorly; apices bluntly angular to narrowly rounded. Snout pointed, soft and flexible vertically due to very delicate rostral cartilage; length 4.3–4.4 times orbit length, interorbital space 1.2–1.3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps broadly lobed; tooth rows in upper jaw ~33. No thorns on central disc or near orbit; 21–26 blunt thorns in median row on tail before dorsal fins, interdorsal thorn usually present. Upper surface densely covered with coarse denticles; undersurface entirely smooth, apart from a few loosely scattered denticles on tail. Tail narrow, tapering to apex, almost rounded in cross-section; lateral folds prominent; 2 small dorsal fins at rear of tail separated slightly (procaudal length much less than snout length); caudal fin rudimentary. Pelvic fin weakly notched, anterior lobe very short; clasper long and slender.

COLOUR. Upper surface plain greyish to greyish brown; 2–4 bands on tail in small juveniles. Ventral surface white, often with dusky posterior disc and pelvic-fin margins, and dusky blotches near tail base.

SIZE. Attains ~182 cm TL. Egg cases ~13 cm long, young hatch at ~21 cm TL.

HABITAT AND BIOLOGY. North Atlantic; Rhode Island (USA) to Norway. Demersal on continental and insular shelves and slopes at 140–1650 m depths, primarily on mid-continental slope deeper than 400 m. Adults feed mainly on fishes, juveniles on small invertebrates. Bycatch of bottom trawl and longline fisheries.

SIMILAR SPECIES. Similar to the Pallid Skate (20.39), which also occurs in the North Atlantic. The Spinetail Skate has a rougher upper surface, usually more tail thorns, and a paler undersurface.

PACIFIC WHITE SKATE 20.52

Bathyraja spinosissima (Beebe & Tee-Van, 1941)

LC

IDENTIFICATION. Large skate with a broad rhombic disc covered above and below with small prickly denticles, snout moderately elongate, eyes small, tail long, no thorns on disc other than alar thorn patches of adult males, and both surfaces pale. Disc ~1.2 times longer than wide; anterior margins undulate, apices broad to narrowly rounded. Snout bluntly angular with small apical lobe at tip, flexible vertically due to delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip; length ~3.8 times orbit length; interorbital space ~1.9 times orbit length. Mouth broad; tooth rows in upper jaw ~34. Disc typically lacking thorns; 23–29 thorns in single median row on tail, thorns small and evenly spaced; no interdorsal thorn. Both disc surfaces rough to touch. Tail slender, longer than precloacal length; 2 tall and rather upright dorsal fins at rear of tail, separated slightly (procaudal length subequal to snout length); lateral folds originating near mid-length of tail; caudal fin elongate. Pelvic fins strongly notched; anterior lobe short and posterior lobe large; claspers long and very slender. Predorsal vertebrae ~82.

COLOUR. Dorsal surface pale greyish white in adults, young sometimes slate grey or brownish. Undersurface also entirely pale, outer disc margin sometimes dusky; sensory pores not dark-edged.

SIZE. Attains at least 150 cm TL, possibly to 203 cm TL. Maturity size unknown; young hatch at ~26 cm TL.

HABITAT AND BIOLOGY. North Pacific; Oregon (USA) to Ecuador, reports from Galapagos Islands and Sea of Okhotsk probably incorrect. Benthopelagic on continental slopes and abyssal plains at 800–2940 m depths. Feeds on benthic fishes. Rarely encountered, with fewer than 10 individuals reported.

SIMILAR SPECIES. In the North-East Pacific, resembles the Roughtail Skate (20.55) in lacking thorns on the nape and shoulder.

MUD SKATE

20.53

Bathyraja taranetzi (Dolganov, 1983)

LC

IDENTIFICATION. Medium-sized skate with a rhombic to heart-shaped disc, rough skin, short snout, large eyes, no thorns on disc, thorns in median tail row small, blotchy dorsally with large white pectoral marking, and white ventrally. Disc anterior margins undulate; apices rather narrowly rounded; snout rounded with a prominent apical tip, soft and flexible vertically due to very delicate rostral cartilage; anterior pectoral radials extending nearly to snout tip; length 3–3.2 times orbit length, interorbital space 1.1–1.3 times orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 29–30. Thorns absent on disc, apart from broad alar series of adult male; thorns of median row on tail small, extending in regular row to first dorsal fin. Dermal denticles coarse, covering most of dorsal surface but less dense in central pectoral region of adult male; undersurface entirely smooth. Tail long and moderately slender, exceeding precloacal length; dorsal fins low, at rear of tail, joined or barely separated, predorsal length subequal to snout length; lateral folds short, extending along posterior half of tail. Pelvic fin notched, anterior lobe broad, shorter than posterior lobe; clasper slender, flattened slightly. Pectoral-fin radials 75–77. Predorsal vertebrae ~100–106; abdominal vertebrae 30–32, predorsal tail vertebrae 70–74.

COLOUR. Dorsal surface of disc brownish, usually with scattered darker blotches and a large white blotch near centre of each pectoral fin; inner margin of orbit white. Undersurface white anteriorly; hind margins of disc and pelvic fins, and part of tail dusky.

SIZE. Attains ~77 cm TL. Males mature at 53–66 cm TL, females 61–66 cm TL.

HABITAT AND BIOLOGY. North Pacific; Sea of Okhotsk to Alaska (USA). Demersal on rough bottoms of continental and insular shelves and slopes at 15–1055 m depths, most common at 250–500 m. Feeds on crustaceans, worms and small fishes.

SIMILAR SPECIES. Almost certainly more closely related to members of the genus *Rhinoraja* than *Bathyraja*, and may need to be reassigned to *Rhinoraja* after completion of a more detailed investigation of the group. Most closely resembles the Whitebelly Skate (20.98) but lacks thorns on the nape.

EREMO SKATE

20.54

Bathyraja trachouros (Ishiyama, 1958)

LC

IDENTIFICATION. Large skate with a rounded to heart-shaped disc, broad snout (length about half head length), rough prickly skin on dorsal surface, small shoulder thorns present, 0–4 nuchal thorns (usually absent), tail longer than 70% of disc width, and disc darker above than below. Disc width 1.2–1.3 times length; anterior margins almost straight, undulate in adult males; apices narrowly to broadly rounded. Snout with blunt tip; soft and flexible vertically due to very delicate rostral cartilage; length ~4.1–4.5 times orbit length; interorbital space slightly larger than orbit; anterior pectoral radials extending to nearly snout tip. Mouth rather broad, nasal flaps broadly lobed. Thorns absent from orbit and snout; small shoulder thorn on each side; 0–4 feeble nuchal thorns, not continuing as row of lumbar thorns even in young; row of mostly 18–23 evenly spaced median thorns along predorsal tail. Upper disc and tail uniformly granular in females and juveniles, denticles thickened and becoming sparse on mid-pectoral region in adult males; anterior pelvic lobe and undersurface smooth. Tail thickened, rounded in cross-section, tapering to apex, subequal to disc length; lateral folds restricted to posterior tail; 2 small dorsal fins at rear of tail barely separated; caudal fin minute. Pelvic fin moderately notched, anterior lobe short and broad, clasper robust. Abdominal vertebrae 32–36, predorsal tail vertebrae 71–76.

COLOUR. Upper surface plain yellowish brown, becoming greyish in preservative, dorsal fins similar to disc; ventral surface of disc white, tail and cloacal region sometimes dusky; sensory pores not marked black.

SIZE. Attains ~102 cm TL. Matures at ~88 cm TL; egg cases 11–13 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off eastern Japan. Demersal on insular shelf and slope at 100–800 m depths. Bycatch of trawl fishery for cod and rockfish. Life history largely unknown.

SIMILAR SPECIES. Differs from the superficially similar Whitebelly Skate (20.98) in having fewer thorns and finer denticles, as well as aspects of its clasper. The Eremo Skate also has a proportionally shorter tail.

ROUGHTAIL SKATE

20.55

Bathyraja trachura (Gilbert, 1892)

LC

IDENTIFICATION. Medium-sized to large skate with a broad rhombic to heart-shaped disc, broad snout (~0.6 of head length), skin mostly smooth in adults, no orbital thorns, no nuchal or shoulder thorns, tail ~3/4 disc width, and very dark above and almost as dark below. Disc 1.2–1.3 times wider than long, anterior margins undulate, double concave in adult males; apices narrowly rounded. Snout with a blunt tip, apex extended slightly; soft and flexible vertically due to very delicate rostral cartilage; length 3.1–3.8 times orbit length; interorbital space 1.4–1.8 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth and nasal flaps broad; tooth rows in upper jaw 26–35. Thorns absent from disc, apart from long, wide alar patch in adult males; row of mostly 14–21 evenly spaced median thorns along predorsal tail, thorns short with broad bases. Upper disc smooth in adult males, except around its margin and over abdomen, females with broader coverage of prickles; tail densely covered with similar prickles; pelvic fins and undersurface smooth. Tail thickened, round to slightly depressed in cross-section, tapering to apex, subequal to disc length; lateral folds mostly narrow; 2 large dorsal fins joined or barely separated, procaudal length subequal to snout length; caudal fin short-based, tall. Pelvic fin deeply notched, anterior lobe only slightly shorter than posterior lobe, clasper long and robust. Abdominal vertebrae 32–37, predorsal tail vertebrae 62–66.

COLOUR. Dorsal surface reddish brown to greyish black. Ventral surface similarly dark, sometimes slightly paler than dorsal surface; sensory pores not marked black.

SIZE. Attains ~94 cm TL. Males mature at ~75 cm TL, females 74–84 cm TL; young hatch at 9–16 cm TL.

HABITAT AND BIOLOGY. North Pacific; northern Japan to California (USA). Demersal on continental and insular shelves and slopes at 90–2900 m depths. Bycatch of trawl fisheries and of no commercial value.

SIMILAR SPECIES. The Deepsea Skate (20.5) is similarly dark on both surfaces, but has a much longer snout and more thorns along the mid-line of the disc.

CRISTINA'S SKATE

20.56

Bathyraja tunae Stehmann, 2005

DD

IDENTIFICATION. Large, heavy-bodied skate with a rhombic disc, broadly elongate snout (length about half head length), upper disc granular and entirely lacking thorns, eyes widely separated, mouth extremely broad, tail much shorter than disc, and uniformly dark greyish on both surfaces. Disc margin deeply concave behind spiracles; apices bluntly angular. Snout pointed and fleshy, soft and flexible vertically due to very delicate rostral cartilage; length 2.4–3.8 times orbit length, interorbital space 1.1–1.5 times orbit length; eyes positioned relatively close to edge of disc; anterior pectoral radials reaching near snout tip. Mouth large, nasal flaps weakly lobed; tooth rows in upper jaw 30–32. No thorns on central disc or near orbit; 19 thorns in median row on tail before dorsal fins, no interdorsal thorns. Upper surface almost entirely covered with fine denticles; undersurface smooth. Tail very short and slender (precloacal length 1.2–1.4 times tail length), tapering to apex, almost triangular in cross-section; lateral folds narrow; 2 small dorsal fins barely separated, procaudal length slightly less than snout length; caudal fin very low. Pelvic fin weakly notched, anterior lobe very short. Pectoral-fin radials ~86–89. Predorsal vertebrae 110–115; abdominal vertebrae 40–44, predorsal tail vertebrae 70–71.

COLOUR. Upper surface plain dark greyish brown, anterior pelvic-fin lobes blackish. Ventral surface slightly darker greyish brown than dorsal surface; sensory pores not marked black.

SIZE. Attains at least 97 cm TL; female holotype adolescent at this size.

HABITAT AND BIOLOGY. South-West Indian Ocean; off Mozambique and Madagascar. Probably benthopelagic on deep continental and insular slopes and abyssal plains at 1700–2240 m depths.

SIMILAR SPECIES. Relationship to another abyssal species, Richardson's Skate (20.44), needs to be reassessed as the species are very similar in body form and occur at similar latitudes in the Southern Hemisphere. The snout length is more than twice the interorbital width (rather than 1.2–1.3 times in Richardson's Skate).

CREAMBACK SKATE

20.57

Bathyraja tzinovskii Dolganov, 1983

LC

IDENTIFICATION. Large skate with a rhombic disc, sharply pointed snout, small eyes, skin spiny and upper disc without thorns, lateral folds extending along entire length of tail, and both surfaces pale without white spots. Disc ~1.2 times wider than long, anterior margins weakly undulate anteriorly; apices narrowly rounded. Snout tip with small lobe; soft and flexible vertically due to very delicate rostral cartilage; length ~4.7 times orbit length; interorbital space up to 1.7 times orbit length; anterior pectoral radials extending nearly to snout tip. Mouth rather broad, nasal flaps broadly lobed; tooth rows in upper jaw ~28. Thorns confined to mid-line of tail, 22 rather large, evenly spaced thorns in row along predorsal tail. Skin on upper disc and tail velvety, uniformly covered with small spinules (no naked patches); undersurface entirely smooth, including lateral folds of tail. Tail thickened, rounded in cross-section, tapering to apex, slightly longer than disc length; 2 small dorsal fins at rear of tail, first larger, bases barely separated; caudal fin rudimentary. Pelvic fin mildly notched, anterior lobe short. Pectoral-fin radials ~72. Predorsal vertebrae ~99; abdominal vertebrae ~30, predorsal tail vertebrae ~69.

COLOUR. Upper surface of disc uniform pale creamish white. Ventral surface uniformly white; sensory pores not marked black.

SIZE. Attains at least 94 cm TL; egg cases ~9 cm long.

HABITAT AND BIOLOGY. North-West Pacific; eastern Japan to Sea of Okhotsk (Russia). Demersal on lower continental and insular slopes and abyssal plain at 1775–2500 m depths; possibly more widespread in Northern Pacific near the bottom in very deep habitats.

SIMILAR SPECIES. Most similar to the Cinnamon Skate (20.15), but has a less angular disc, relatively larger eyes and is paler bodied. Another North-West Pacific species of the genus *Bathyraja*, the Raspback Skate (20.21), has much shorter lateral folds and the central part of each pectoral fin is not evenly covered with denticles in adults.

OKHOTSK SKATE 20.58

Bathyraja violacea (Suvorov, 1935)

DD

IDENTIFICATION. Large skate with a thin, flabby rhombic disc, short snout, granular dorsal disc with broad median band in adults, no thorns on disc, very small tail thorns arranged in irregular median row, short anterior pelvic-fin lobes, and strongly variegated colour pattern. Disc angular, ~1.1 times wider than long; anterior margins weakly undulate in females, more so in adult males; apices narrowly rounded. Snout broad with minute lobe at tip; soft and flexible vertically due to very delicate rostral cartilage; length ~3.4–3.9 times orbit length; interorbital space slightly larger than orbit length; anterior pectoral radials extending to nearly snout tip. Mouth rather narrow, nasal flaps broadly lobed. No thorns on orbit, snout, nape and shoulder; 8–15 weak thorns in median row on tail before first dorsal fin. Upper surface always covered with denticles, less dense over gills and bases of pectoral and pelvic fins in adults; undersurface uniformly smooth. Tail flattened, tapering to apex, slightly longer than disc; lateral folds prominent on posterior tail; 2 small dorsal fins barely separated, procaudal length subequal to snout length; caudal fin minute. Pelvic fin with weak notch; clasper rather broad, tip narrowly rounded. Pectoral-fin radials 73–76. Predorsal vertebrae 98–102; abdominal vertebrae 28–33, predorsal tail vertebrae 66–70.

COLOUR. Upper surface pale greyish brown to brown, usually covered with well-defined darker brown blotches and mottling. Ventral surface of disc white, apart from dark patches around cloaca and on tail; sensory pores not marked black.

SIZE. Attains ~107 cm TL. Males mature at 54–73 cm TL, females 61–76 cm TL; egg cases ~13 cm long.

HABITAT AND BIOLOGY. North Pacific; northern Japan, across to Alaska (USA). Demersal on continental and insular shelves and slopes at 25–1110 m depths. Feeds mostly on crustaceans, cephalopods and bony fishes.

SIMILAR SPECIES. Resembles the Duskypink Skate (20.13), but its anterior pelvic-fin lobes are proportionally much shorter compared to the posterior lobes.

ENIGMA SKATE

20.59

Brochiraja aenigma Last & McEachran, 2006

DD

IDENTIFICATION. Small skate with a broad subcircular disc covered with closely set granular denticles on upper surface, skin smooth below, no thorns on disc, tail very long and very slender, and largely brownish in coloration on both surfaces. Disc ~1.4 times broader than long; apex broadly rounded. Snout moderately elongate, flexible, rostral cartilage feeble, lobe at tip minute. Eye large, length ~2.4 in snout length, ~1.1 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe developed; tooth rows in upper jaw ~30. Dorsal denticles very short, regularly spaced on disc, sparse on pelvic, dorsal and anal fins; absent ventrally. No thorns on disc, including possibly snout thorns; thorns probably present in alar region of adult males; tail with row of small long-based thorns interspersed with fine denticles. Tail very narrow based, tapering gently, length ~1.7 times precloacal length; lateral folds probably weak. Pelvic-fin margin deeply notched. Dorsal fins short and low, barely separated, procaudal length slightly longer than snout length; caudal-fin upper lobe subequal to length of second dorsal-fin base. Pectoral-fin radials ~73–74. Predorsal tail vertebrae ~89, abdominal vertebrae ~26, predorsal vertebrae ~115.

COLOUR. Brownish above (in preservative) with faint darker mottling; tips of anterior pelvic-fin lobes black. Ventral surface brownish to greyish with white areas around mouth and on gill slits; chin area dark; lacking rows of pale-edged sensory pores.

SIZE. Attains at least 44 cm TL for females; adult size unknown.

HABITAT AND BIOLOGY. South-West Pacific; Wanganella Bank, off northern New Zealand. Demersal at 420–435 m depths, presumably narrow-ranging on deep offshore banks of the Tasman Sea. Life history unknown.

SIMILAR SPECIES. Known from a single individual and preserved in poor condition. This unusual skate has a very long and slender tail, and unusually high meristic counts.

WHITELIP SKATE

20.60

Brochiraja albilabiata Last & McEachran, 2006

DD

IDENTIFICATION. Medium-sized skate with an oval to heart-shaped disc, largely smooth skin, single thorn before each eye, v-shaped thorn on snout, very long slender tail, and all surfaces of body bluish with white-edged mouth. Disc most curvaceous in adults, ~1.2 times broader than long; apex broadly rounded. Snout rather short, flexible, lacking firm rostral cartilage, with distinct fleshy lobe at tip. Eye large, length 2.5–2.7 in snout length, 1.1–1.2 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 45–60. Dorsal denticles very short and dense, confined mainly to back and sides of tail; entirely smooth ventrally. Preorbital and rostral thorns broad based, latter much closer to snout tip than eye; alar and malar thorns forming large patch; thorns on tail small, in a staggered median row. Tail oval, tapering gently, length 1.6–1.7 times precloacal length; lateral folds well developed. Pelvic-fin margin deeply notched. Dorsal fins short, well separated, procaudal length about equal to prespiracular length; caudal-fin upper lobe much longer than second dorsal-fin base. Pectoral-fin radials 68–70. Predorsal tail vertebrae 79–83, abdominal vertebrae 26–27, predorsal vertebrae 106–110.

COLOUR. Plain greyish blue above, interorbit and anterior pelvic fin brownish. Ventral surface darker, uniform bluish black with dark brown hues; mouth white-edged and strongly contrasted against blackish nasal flaps and beard-like patch on chin; no rows of white sensory pores.

SIZE. Attains at least 65 cm TL; maturity size unknown (largest male still immature at ~51 cm TL).

HABITAT AND BIOLOGY. South-West Pacific; off northern New Zealand. Demersal along insular slope at 900–1005 m depths. Nothing known of its life history.

SIMILAR SPECIES. Formerly confused with the Smooth Deepsea Skate (20.61) and other similar species. The Whitelip Skate has a longer and more densely prickled tail.

SMOOTH DEEPSEA SKATE

20.61

Brochiraja asperula (Garrick & Paul, 1974)

DD

IDENTIFICATION. Medium-sized skate with an oval to heart-shaped disc, largely smooth skin, thorns before and after eye, v-shaped thorn on snout, long slender tail, and whitish to greyish brown above and darker ventrally. Disc most curvaceous in adults, 1.2–1.3 times broader than long; apex broadly rounded. Snout rather short, flexible, lacking firm rostral cartilage, with distinct fleshy lobe at tip. Eye large, length 2.4–2.8 in snout length, 1.2–1.5 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 49–66. Dorsal denticles short, in broad median band on back and extending onto tail; entirely smooth ventrally. Single thorn on preorbit, up to 4 thorns posteriorly around eye; rostral thorn broad based, slightly forward of mid-snout; alar thorn patch well developed in adult males; tail thorns in regular median row, shorter lateral rows sometimes present. Tail oval, tapering gently, length 1.3–1.4 times precloacal length; lateral folds well developed posteriorly. Pelvic-fin margin deeply notched. Dorsal fins short, well separated, procaudal length slightly exceeding prespiracular length; caudal-fin upper lobe slightly longer than second dorsal-fin base. Pectoral-fin radials 66–71. Predorsal tail vertebrae 65–70, abdominal vertebrae 26–28, predorsal vertebrae 91–97.

COLOUR. Variable, plain whitish, greyish, brownish or purplish above, without distinct bluish hues. Ventral surface always darker, varying from greyish to brownish, and darkest on snout and around mouth; no rows of white sensory pores.

SIZE. Attains at least 78 cm TL; males mature at ~51 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Zealand. Demersal along insular slopes to depths of ~1150 m, but typically in 300–600 m. Nothing known of its life history.

SIMILAR SPECIES. Members of this genus typically have a single thorn with divergent spiny tips (appears v-shaped) on the snout that is usually most prominent in young. Several species occur on deep plateaus and along the insular slopes surrounding New Zealand.

EUREKA SKATE

20.62

Brochiraja heuresa Last & Séret, 2012

NE

IDENTIFICATION. Small skate with a broadly oval to weakly heart-shaped disc, skin velvety on dorsal surface, 1–2 orbital thorns, small v-shaped thorn on snout, long tail, and bluish pink above and reddish brown ventrally. Disc less curvaceous in young, 1.1–1.2 times broader than long; apex broadly rounded. Snout medium-size, flexible, only basal part of rostral cartilage firm, with small lobe at tip. Eye rather large, orbit length 2.7–3.4 in snout length, 0.9–1.1 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 30–42. Dorsal denticles small, closely set; disc smooth ventrally, tail usually rough near its base. Thorns weak, confined to snout, orbits, tail, and alar region of mature males; rostral thorn often rudimentary, slightly forward of mid-snout; preorbital thorn minute, postorbital thorn sometimes present; alar patch broad; thorns on mid-line of tail barely larger than adjacent denticles. Tail rather slender, tapering towards tip, length 1.2–1.3 times precloacal length; lateral skin folds very well developed posteriorly. Pelvic-fin margin deeply notched, anterior lobe fleshy. Dorsal fins short, barely separated, procaudal length slightly less than prespiracular length; caudal-fin upper lobe subequal to second dorsal-fin base. Pectoral-fin radials 58–63. Predorsal tail vertebrae 65–76, abdominal vertebrae 22–26, predorsal vertebrae 88–100.

COLOUR. Uniform bluish pink above, anterior pelvic-fin lobe reddish brown. Ventral surface of disc largely reddish brown, mouth white; tail brownish and white; sensory pores white, well defined.

SIZE. Adult males to at least 38 cm TL; maturity size probably similar as several males still adolescent at 36 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; northern Tasman Sea. Demersal on deep-sea banks and insular slopes at 870–1350 m depths. Life history unknown.

SIMILAR SPECIES. Superficially similar in appearance to the very rare and sympatric Enigma Skate (20.59), but differs markedly in dimensions and counts.

BLUE DEEPSEA SKATE

20.63

Brochiraja leviveneta Last & McEachran, 2006

DD

IDENTIFICATION. Medium-sized skate with a strongly heart-shaped disc in adults, largely smooth skin, 2 orbital thorns, large v-shaped thorn on snout, long slender tail, and bluish above and darker bluish brown ventrally. Disc less curvaceous in young, only slightly broader than long; apex broadly rounded. Snout medium-size, flexible, lacking firm rostral cartilage, with broad-based lobe at tip. Eye large, length 2.6–3.4 in snout length, 1.2–1.6 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 32–43. Dorsal denticles very short, confined to narrow median band on back and extending onto sides of tail; entirely smooth ventrally. Thorns on disc confined to mid-snout, orbit and malar and alar regions of mature males; single broad-based thorn on preorbit, one on postorbit; rostral thorn broad based, close to snout apex; 2 malar patches, alar and posterior malar patches joined; tail thorns in regular median row. Tail oval, tapering gradually, length 1.3–1.5 times precloacal length; lateral folds well developed posteriorly. Pelvic-fin margin deeply notched. Dorsal fins short, almost connected, procaudal length slightly shorter than prespiracular length; caudal-fin upper lobe much longer than second dorsal-fin base. Pectoral-fin radials 64–69. Predorsal tail vertebrae 70–75, abdominal vertebrae 24–27, predorsal vertebrae 95–100.

COLOUR. Pale to medium greyish blue above, usually darker on head and around outer disc; anterior pelvic-fin lobe much darker than posterior lobe; dorsal fins bluish with white bases. Ventral surface of disc dark bluish brown with bluish black border; tail greyish blue with white tip; white sensory pores strongly demarcated.

SIZE. Attains at least 51 cm TL; males mature at ~43 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Zealand. Demersal on insular slopes and plateaus at 300–1200 m depths, but typically in 900–1100 m. Little known of its life history.

SIMILAR SPECIES. Distinctive smooth-skinned member of this genus distinguished from the Whitelip (20.60) and Smooth Deepsea (20.61) Skates by its coloration, more angular disc and the presence of 2 malar thorn patches on each side in males.

SMALL DEEPSEA SKATE

20.64

Brochiraja microspinifera Last & McEachran, 2006

DD

IDENTIFICATION. Small skate with a weak heart-shaped disc in adults, skin rough on dorsal surface, 1 orbital thorn, small v-shaped thorn on snout, moderately elongate tail, and both surfaces of disc dark brownish. Disc less curvaceous in young, 1.1–1.2 times broader than long; apex broadly rounded. Snout medium-size, flexible, only basal part of rostral cartilage firm, with broad-based lobe at tip. Eye rather large, length 2.1–2.8 in snout length, 1.1–1.6 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 33–37. Dorsal denticles small, rather widely and irregularly spaced, sometimes partly embedded; band of larger denticles extending along sides of tail; entirely smooth ventrally. Thorns confined to posterior mid-disc, tail, snout, preorbit, and alar regions of mature males; single broad-based thorn on preorbit, absent from postorbit; rostral thorn closer to orbit than snout apex; no separate malar patch, alar patch small; tail thorns in regular median row. Tail narrow based, tapering gradually, length 1.2–1.4 times precloacal length; lateral folds well developed posteriorly. Pelvic-fin margin deeply notched. Dorsal fins short, barely separated, procaudal length usually longer than prespiracular length; caudal-fin upper lobe longer than second dorsal-fin base. Pectoral-fin radials 58–63. Predorsal tail vertebrae 59–64, abdominal vertebrae 22–25, predorsal vertebrae 81–88.

COLOUR. Medium to dark brown above; often with blackish peppery spots, some parts including snout tip and fins slightly darker. Ventral surface uniformly dark brown or mottled; white sensory pores usually demarcated.

SIZE. Attains at least 33 cm TL; males mature at ~27 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off North Island of New Zealand. Demersal on insular slope at 600–1200 m depths. Nothing known of its life history.

SIMILAR SPECIES. Smallest member of this genus, distinguished from the rough-skinned Spiny Deepsea Skate (20.65) by its darker coloration, lower vertebral count, and smaller alar thorn patches in adult males.

SPINY DEEPSEA SKATE

20.65

Brochiraja spinifera (Garrick & Paul, 1974)

DD

IDENTIFICATION. Medium-sized skate with a broad heart-shaped disc, skin rough on dorsal surface, rosette of orbital thorns, v-shaped thorn on snout, moderately elongate tail, and upper surface paler than ventral surface. Disc less curvaceous in young, 1.1–1.3 times broader than long; apex broadly rounded. Snout medium-size, flexible, only basal part of rostral cartilage firm, with broad-based lobe at tip. Eye large, length 2.5–2.9 in snout length, 1.3–1.5 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 47–65. Dorsal denticles small, closely set, covering disc and tail including dorsal and caudal fins; disc smooth ventrally, tail usually rough near its base. Thorns confined to snout, orbit, posterior disc, tail, scapular region of large females, and alar region of mature males; rostral thorn small, slightly forward of mid-snout; 5–11 thorns beside orbit; no obvious malar patch, alar patch large; tail thorns in multiple irregular rows. Tail slender, very narrow towards tip, length 1.4 times precloacal length; lateral folds short, well developed posteriorly. Pelvic-fin margin deeply notched. Dorsal fins short, separated slightly, procaudal length typically subequal to prespiracular length; caudal-fin upper lobe longer than second dorsal-fin base. Predorsal tail vertebrae 74–79, abdominal vertebrae 24–27, predorsal vertebrae 98–105.

COLOUR. Uniform bluish grey to greyish brown above; rarely whitish or with irregular blackish blotches; anterior pelvic-fin lobes and tail fins usually bluish black. Ventral surface dark; head usually dark grey to black, rest of disc paler grey or brown, tail greyish to white; sensory pores greyish.

SIZE. Attains ~84 cm TL; males mature from ~61 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Zealand. Demersal and widespread on insular shelves and slopes at 125–1500 m depths, primarily in 400–800 m. Caught as bycatch in the Orange Roughy (*Hoplostethus atlanticus*) fishery.

SIMILAR SPECIES. Exists as several colour forms that are geographically separated and may constitute separate species.

RIBBONTAIL SKATE

20.66

Brochiraja vittacauda Last & Séret, 2012

NE

IDENTIFICATION. Medium-sized skate with a suboval to heart-shaped disc, 2–4 orbital thorns, small v-shaped thorn on snout, skin largely smooth on dorsal surface, long tail with very broad skin folds, skin bluish to reddish brown above, and darker bluish brown below. Disc probably less curvaceous in young, 1–1.1 times broader than long; apex broadly rounded. Snout medium-size, flexible, basal part of rostral cartilage firm, with small lobe at tip. Eye large, length 2.8–3.1 in snout length, 1.1–1.2 times interorbital space. Mouth arched slightly, nasal flaps broadly lobed, dermal fringe weak; tooth rows in upper jaw 40–44. Dorsal denticles minute, confined to narrow median band extending along disc and onto tail; entirely smooth ventrally. Thorns confined to mid-snout, orbits, mid-line of tail, and well-developed alar and malar patches in adult males; rostral thorn forward on snout; malar thorns in 2 patches, anteriormost forward of orbit; alar patch well developed; thorns on tail enlarged slightly, in regular row on mid-line. Tail rather slender, tapering towards tip, length 1.4–1.6 times precloacal length; lateral folds very well developed. Pelvic-fin margin deeply notched, anterior lobe fleshy. Dorsal fins low, separated slightly, procaudal length equal to or slightly greater than snout length; caudal-fin upper lobe subequal to second dorsal-fin base. Pectoral-fin radials ~76–77. Predorsal tail vertebrae 84–86, abdominal vertebrae ~28, predorsal vertebrae 112–114.

COLOUR. Disc largely violet above; outer disc, pelvic fins and tail reddish brown. Ventral surface of disc slightly darker, bluish brown; tips of tail and anterior pelvic-fin lobes white; white sensory pores well defined.

SIZE. Attains at least 72 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; northern Tasman Sea. Demersal on deep-sea banks and insular slopes at 630–975 m depths. Only known from 2 individuals.

SIMILAR SPECIES. Occurs with the Enigma Skate (20.59) on the West Norfolk Ridge, but is probably larger in size, and can be distinguished by a less granular disc and better-developed thorn patches around the eyes.

EASTERN LOOSESKIN SKATE

20.67

Insentiraja laxipella Yearsley & Last, 1992

DD

IDENTIFICATION. Medium-sized skate with a subcircular to weakly heart-shaped disc and very long tail, skin velvety and flabby over upper surface of disc and tail, typically lacking thorns, no dorsal fins, and uniformly pale blue above. Disc heart-shaped in adult males, more circular in females and young, apices broadly rounded, broader than long. Snout flexible, with a fleshy lobe at tip, lacking a firm rostral cartilage; moderately elongate in adults, its length 3.7–5.3 times orbit length; orbit small, 1–1.3 in interorbital space. Mouth rather wide, nasal flaps broadly lobed; tooth rows in upper jaw 32–39. Dorsal disc and tail uniformly covered with fine denticles; all thorns absent apart from alar patch in adult males; skin on ventral surface loose and entirely smooth. Tail very slender, mostly circular in cross-section, its length 1.2–1.4 times precloacal length; lateral folds well developed, widening toward tail tip. Pelvic-fin margin deeply notched, anterior lobes long. Dorsal fins absent, caudal fin obscure. Pectoral-fin radials 64–66. Abdominal vertebrae 24–26, total tail vertebrae (to tail tip) 94–95.

COLOUR. Uniformly pale bluish above, paler anteriorly on disc; anterior lobe of pelvic fin darker, greyish brown; tail with white patches; caudal fin and lateral folds bluish black. Undersurface with skin almost transparent, revealing light and dark areas beneath; tail white to greyish blue.

SIZE. Largest known specimen a 57 cm TL adult male.

HABITAT AND BIOLOGY. South-West Pacific; Coral Sea off north-eastern Australia. Demersal on continental and insular slopes at ~800–880 m depths. Known from very few specimens and nothing known of its biology.

SIMILAR SPECIES. Resembles the Western Looseskin Skate (20.68) in general appearance, but is distinguishable from this species, and all other softnose skates in the Australasian region, in lacking dorsal fins on the tail; the Longtail Skate (20.1) from New Zealand seas has a single dorsal fin.

WESTERN LOOSESKIN SKATE 20.68

Insentiraja subtilispinosa (Stehmann, 1989)

LC

IDENTIFICATION. Medium-sized skate with a subcircular to weakly heart-shaped disc and very long tail, skin velvety and flabby over upper surface of disc and tail, pair of orbital thorns present but no other thorns on disc or tail, 2 posteriorly positioned dorsal fins, and dark bluish above. Disc heart-shaped in adult males, more circular in females and young, apices broadly rounded, broader than long. Snout flexible, with a fleshy lobe at tip, lacking a firm rostral cartilage; moderately elongate in adults, its length 3.7–4.9 times orbit length; orbit small, length 1–1.1 in interorbital space. Mouth rather wide, nasal flaps broadly lobed; tooth rows in upper jaw 40–47. Dorsal disc and tail uniformly covered with fine denticles; single preorbital thorn, thorns absent from all other regions apart from alar patch in adult males; skin on ventral surface loose and entirely smooth. Tail very slender, mostly circular in cross-section, its length 1.4–1.6 times precloacal length; lateral folds well developed, widening toward tail tip. Pelvic-fin margin deeply notched, anterior lobes long. Dorsal fins small, situated close together; caudal fin low. Claspers long, very slender. Pectoral-fin radials 57–64. Predorsal vertebrae 98–107, abdominal vertebrae 23–27, predorsal tail vertebrae 74–83.

COLOUR. Medium to dark blue above, often with irregular white flecks; anterior margins of disc and snout tip not paler than remainder of disc; tail and anterior pelvic-fin lobe bluish brown; dorsal and caudal fins bluish black; lateral folds black. Claspers dark above, usually paler below. Skin of ventral surface almost transparent; bluish brown beneath, darkest on outer disc; tail pale.

SIZE. Attains at least 57 cm TL; males mature at ~50 cm TL.

HABITAT AND BIOLOGY. Western Pacific and Eastern Indian Ocean; subtropical Western Australia to Philippines. Demersal, with patchy distribution on continental and insular slopes at 320–1460 m depths, generally in 900–1110 m depth interval. Little known of its biology.

SIMILAR SPECIES. Most similar to the Eastern Looseskin Skate (20.67), but distinguishable from this species in having a darker body colour and retaining both dorsal fins. Populations differ subtly in morphology across its range.

SOUTHERN ROUND SKATE 20.69

Irolita waitii (McCulloch, 1911)

LC

IDENTIFICATION. Medium-sized skate with a smooth subcircular disc, rather short tail, few orbital thorns, dense coverage of white pores on ventral surface and clusters of fine bluish spots dorsally. Disc almost circular, slightly broader than long. Snout very short, broad, flexible, lacking a firm rostral cartilage, with fleshy lobe at tip, its length 2.3–3 times orbit length; interorbital space 1.1–1.5 times orbit length. Mouth broad, nasal flaps broadly lobed, lacking a dermal fringe; tooth rows in upper jaw 41–51. Both surfaces of disc and tail without granular denticles; no nuchal or malar thorns, usually with single thorn before and after eye; alar thorns in narrow band; tail thorns short, usually in 3 rows on dorsal mid-line. Tail very depressed, barely tapering, its length ~0.9–1 times precloacal length; lateral folds very well developed. Pelvic-fin margin deeply incised. Dorsal fins small, upright, separated slightly, at tip of tail; caudal fin minute. Pectoral-fin radials 101–105. Predorsal vertebrae 103–112, abdominal vertebrae 39–43, predorsal tail vertebrae 62–69.

COLOUR. Pale yellowish to brown above with clusters of small blue spots mixed with similar aggregations of small brownish spots; bluish spots forming eye-sized ocelli on disc; pale with brownish peppering on orbit; skin folds pale; clasper pale with brown peppering dorsally; dorsal fins brownish. Undersurface greyish to black, often darker on head; sensory pores white.

SIZE. Attains ~52 cm TL; males mature at ~46 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean; off south-western Australia. Demersal on mid- and outer continental shelf at 50–200 m depths. Caught occasionally as bycatch and typically discarded. Nothing known of its biology.

SIMILAR SPECIES. Similar to the Western Round Skate (20.70), but has a shorter tail, usually has orbital thorns (otherwise absent), and has a more complex pattern of blue spots and ocelli on the dorsal disc.

WESTERN ROUND SKATE

20.70

Irolita westraliensis Last & Gledhill, 2008

DD

IDENTIFICATION. Small skate with a smooth subcircular disc, rather long tail, usually lacking orbital thorns, dense coverage of greyish pores on ventral surface and widely spaced bluish spots dorsally. Disc almost circular, becoming weakly heart-shaped in adult males; slightly broader than long. Snout very short, broad, flexible, lacking a firm rostral cartilage, with minute fleshy lobe at tip, its length 1.9–3.1 times orbit length; interorbital space 1.1–1.3 times orbit length. Mouth broad, nasal flaps broadly lobed, lacking a dermal fringe; tooth rows in upper jaw 39–47. Both surfaces of disc and tail without granular denticles; no nuchal or malar thorns, orbital thorns rarely present; alar thorns in narrow band; tail thorns enlarged, 3–5 irregular rows. Tail slender, almost oval in cross-section, tapering slightly, its length ~1–1.2 times precloacal length; lateral folds not really well developed. Pelvic-fin margin deeply incised. Dorsal fins small, tilted, separated slightly, near tip of tail; caudal fin minute. Pectoral-fin radials 87–94. Predorsal vertebrae 97–103, abdominal vertebrae 35–39, predorsal tail vertebrae 59–64.

COLOUR. Brownish with widely spaced bluish spots (not arranged in distinct clusters) of varying sizes above, some enlarged beside eye, on back and just in advance of pectoral-fin insertion; usually with a single dark brown spot on eye membrane; 3–4 brownish bands on tail; dorsal fins brownish; clasper brownish above, pale below. Undersurface greyish green to dark brown; sensory pores with greyish centres.

SIZE. Attains ~43 cm TL; males mature at ~35 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean; off central Western Australia. Demersal on outer continental shelf at 140–210 m depths. Caught rarely and discarded as bycatch. Life history unknown.

SIMILAR SPECIES. Similar to the Southern Round Skate (20.69), but has a longer tail, usually lacks orbital thorns, and has a simpler pattern of larger and more widely spaced bluish spots on the dorsal disc.

ALIS' VELVET SKATE

20.71

Notoraja alisae Séret & Last, 2012

NE

IDENTIFICATION. Medium-sized skate with a velvety, heart-shaped disc in adults, long slender tail, single thorn before each eye but no other enlarged thorns on head or tail, and plain greyish brown coloration on both surfaces of disc. Disc somewhat rounded in young, becoming more curvaceous in adults, broader than long; apex broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with distinct fleshy lobe at tip. Eye rather large, orbit length 2.6–3.1 in snout length, 1.1–1.4 times interorbital space. Mouth medium-sized, arched, nasal flaps broadly lobed, lacking dermal fringe; tooth rows in upper jaw 34–45. Both surfaces of disc and tail densely covered with fine bristle-like denticles giving skin a velvety feel. Preorbital thorn rudimentary; alar and malar patches joined, thorns small. Tail narrow-based, oval in cross-section, tapering gently to its tip, length 1.4–1.6 times precloacal length; lateral folds confined to posterior half of tail, wide near tail tip. Pelvic-fin margins deeply notched. Dorsal fins short and rather tall, separated slightly, procaudal length about equal to snout length; caudal-fin upper lobe longer than second dorsal-fin base. Pectoral-fin radials 61–64. Predorsal vertebrae 72–82, abdominal vertebrae 24–25, predorsal tail vertebrae 96–107.

COLOUR. Plain pale greyish brown to dark grey above. Ventral surface similarly greyish or slightly paler; sensory pores white, most pronounced in dark specimens.

SIZE. Attains at least 55 cm TL; males mature at ~46 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; New Zealand to Vanuatu. Demersal on insular slopes, probably mainly on hard bottoms, at 870–1050 m depths. Caught rarely and nothing known of its life history.

SIMILAR SPECIES. Belongs to a group of Western Pacific skates, also known as 'velcro skates' or 'velvet skates', because of the velvety nature of their skin. Members of the group are also similar in appearance, differing subtly in morphology and counts.

BLUE SKATE

20.72

Notoraja azurea McEachran & Last, 2008

LC

IDENTIFICATION. Medium-sized skate with a velvety, heart-shaped disc, long slender tail, single small preorbital and postorbital thorns, 2 irregular rows of thorns on anterior half of tail and median row on posterior half of tail, and greyish blue dorsally and greyish brown ventrally. Disc more subcircular in females and juveniles, 1.1–1.2 times broader than long; anterior margins strongly undulate in males, outer corners broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage; tip with prominent fleshy process. Eye moderately large, orbit length 3.3–4.2 in snout length, 1.3–1.4 times interorbital space. Mouth rather narrow, slightly arched; nasal flaps broadly lobed, its posterior margin smooth; tooth rows in upper jaw 32–43. Juveniles covered uniformly with fine bristle-like dermal denticles, giving skin a velvety feel; adults largely smooth, except along disc margins and dorsal mid-line; ventral surface smooth. Tail long and very slender, oval in cross-section, tapering gently to its tip; length 1.2–1.4 times precloacal length; lateral folds well developed. Pelvic-fin margins deeply notched. Dorsal fins rather short and moderately tall, usually separated slightly, caudal-fin upper lobe distinctly longer than second dorsal-fin base. Pectoral-fin radials 66–69. Predorsal vertebrae 76–79, trunk vertebrae 25–27, predorsal tail vertebrae 103–104.

COLOUR. Dorsal surface plain greyish blue to dark blue, sometimes with fine dark spots. Ventral surface medium brown centrally, dark bluish black along margins, frequently pale around gill slits and mouth; sensory pores sometimes pale.

SIZE. Attains at least 65 cm TL. Males mature at ~53 cm TL; young hatch at ~20 cm TL.

HABITAT AND BIOLOGY. South-West Pacific and South-East Indian Ocean; off southern Australia. Benthic on continental slope at 765–1440 m depths. Caught occasionally by deep-sea trawlers but biology unknown.

SIMILAR SPECIES. Resembles the Blotched Skate (20.80), also from southern Australia, but their colour patterns are clearly distinct (plain bluish *vs.* mottled dorsally in the Blotched Skate).

FIJIAN VELVET SKATE

20.73

Notoraja fijiensis Séret & Last, 2012

NE

IDENTIFICATION. Small to medium-sized skate with a velvety, heart-shaped disc, long tail, small thorn before each eye but no other enlarged thorns on head or tail, and pale yellowish brown above and paler ventrally. Disc probably rounded in young, becoming more curvaceous in adults, broader than long; apex broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with small triangular lobe at tip. Eye rather large, orbit length 2.5–3.3 in snout length, 1.2–1.4 times interorbital space. Mouth rather small, arched slightly, nasal flaps with weak lobes, lacking dermal fringe; tooth rows in upper jaw 32–38. Both surfaces of disc and tail densely covered with fine bristle-like denticles giving skin a velvety feel. Preorbital thorn conspicuous; form of alar and malar patches unknown; slightly enlarged denticles on tail but no thorns. Tail narrow-based, oval in cross-section, tapering gently to its tip, length 1.3–1.4 times precloacal length; lateral folds confined to posterior half of tail, not expanded near tail tip. Pelvic-fin margins very deeply notched. Dorsal fins flag like, rather tall, barely separated, procaudal length about equal to snout length; caudal-fin upper lobe much longer than second dorsal-fin base. Pectoral-fin radials 64–66. Predorsal vertebrae 77–81, abdominal vertebrae 25, predorsal tail vertebrae 102–106.

COLOUR. Plain pale yellowish brown, outer margin of disc paler; dorsal and caudal fins and mid-line of tail dusky. Ventral surface uniformly creamy white.

SIZE. Attains at least 40 cm TL; a male was immature at 31 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; endemic to Fiji. Demersal on nearby insular slopes at 565–700 m depths. Nothing known of its life history.

SIMILAR SPECIES. A velcro skate distinguished from the similar Alis' Velvet Skate (20.71) from oceanic ridges to the west, by its more conspicuous preorbital thorns, paler coloration above, darker dorsal fins, and being white ventrally (rather than greyish).

AUSTRALIAN GHOST SKATE

20.74

Notoraja hirticauda Last & McEachran, 2006

DD

IDENTIFICATION. Small skate with a velvety, heart-shaped disc in adults, long slender tail prickly ventrally, single small preorbital thorn, but no other enlarged thorns on head or tail, and pale on both surfaces of disc. Disc heart-shaped in adult males, subcircular in juveniles, 1.1–1.2 times broader than long; anterior margins strongly undulate in adult males, outer corner broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with fleshy and flattened lobe at tip. Eye small to moderate, orbit length 2.3–4.2 in snout length, 1.1–1.3 times interorbital space. Mouth rather narrow, slightly arched, nasal flaps broadly lobed, posterior margin smooth; tooth rows in upper jaw 32–39. Dorsal surface of disc and tail covered with fine bristle-like denticles giving skin a velvety feel; denticles in irregular rows on tail; ventral surface of disc smooth, ventral surface of tail mostly prickly. Tail long and very slender, narrow-based, oval in cross-section, tapering gently to its tip, length 1.4–1.5 times precloacal length; lateral folds indistinct. Pelvic-fin margins deeply notched. Dorsal fins very small, lanceolate, close together; caudal-fin upper lobe low, longer than second dorsal-fin base. Pectoral-fin radials 61–66. Predorsal vertebrae 71–76, trunk vertebrae 24–27, predorsal tail vertebrae 95–102.

COLOUR. Dorsal surface uniformly pale. Ventral surface white or translucent; sensory pores not pigmented.

SIZE. Attains at least 45 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia (Shark Bay to Monte Bello Islands). Demersal on continental slope at 500–760 m depths. Biology unknown.

SIMILAR SPECIES. Resembles the Pale Skate (20.78) because both sides of the disc are pale. However, the Pale Skate, which occurs in the Pacific Ocean (off Queensland, Australia), has 1–3 irregular rows of tail thorns (*vs.* no thorn rows) and the tail is smooth ventrally (*vs.* prickly).

STRANGE SKATE

20.75

Notoraja inusitata Séret & Last, 2012

NE

IDENTIFICATION. Medium-sized skate with a heart-shaped disc with only upper surface velvety, long tail, small thorn before each eye and row of small thorns on tail, and disc darker above than below. Disc weakly undulate, broader than long; apex broadly rounded. Snout rather long, flexible, with very flexible rostral cartilage and prominent triangular lobe at tip. Eye small, orbit length ~3.7 in snout length, subequal to interorbital space. Mouth rather narrow, jaws weakly arched, long nasal flaps with widely separated lobes, coarsely fringed; tooth rows in upper jaw ~41. Upper surface of disc densely covered with fine bristle-like denticles giving skin a velvety feel; ventral surface of disc smooth, most of tail covered with denticles. Preorbital thorn conspicuous, no other thorns on head; ~45 similar thorns in irregular row on tail; form of alar and malar patches unknown. Tail narrow-based, oval in cross-section, slightly expanded near dorsal fins, length ~1.4 times precloacal length; lateral folds extending over full length of tail, expanded slightly near tail tip. Pelvic-fin margins deeply notched, anterior lobe about equal to posterior lobe. Dorsal fins short, tall, well separated, procaudal length much shorter than snout length; caudal-fin upper lobe low, longer than second dorsal-fin base. Pectoral-fin radials ~74. Predorsal vertebrae ~81, abdominal vertebrae ~27, predorsal tail vertebrae ~108.

COLOUR. Dorsal surface uniformly pale greyish brown; orbits, margins of dorsal and caudal fins, and tail folds darker. Ventral surface white to partly translucent.

SIZE. Only known specimen a 44 cm TL juvenile male.

HABITAT AND BIOLOGY. South-West Pacific; possibly endemic to Vanuatu. Demersal on nearby insular slopes at 805–845 m depths.

SIMILAR SPECIES. Like the Pale Skate (20.78) from the Oceania region it has velvety skin on the upper surface of the disc but is smooth ventrally.

BROKEN RIDGE SKATE

20.76

Notoraja lira McEachran & Last, 2008

LC

IDENTIFICATION. Small skate with a velvety, heart-shaped disc, moderately long, but extremely slender tail, single small preorbital thorn, regular row of thorns on back of disc and 2 irregular rows on tail, and pale bluish with whitish areas on both surfaces of disc. Disc ~1.1 times broader than long; anterior margins undulate, outer corners broadly rounded. Snout prominent, flexible, lacking firm rostral cartilage, with distinct fleshy and flattened process at tip. Eye moderate, orbit length ~4.2 in snout length, ~1.2 times interorbital space. Mouth rather narrow, slightly arched, nasal flaps broadly lobed, posterior margin coarsely fringed; tooth rows in upper jaw 36. Dorsal surface of disc with broad bands of dermal denticles along anterior margins of disc and on cranium, ventral surface smooth. Tail extremely slender and tapering, narrow-based, slightly depressed, convex ventrally, length ~1.2 times precloacal length; lateral folds confined to posterior half of tail. Pelvic-fin margins deeply notched. Dorsal fins similar in shape and size, lanceolate, separated at base; caudal-fin upper lobe separated by short interspace from and distinctly longer than second dorsal-fin base. Pectoral-fin radials 62–63. Predorsal vertebrae ~70, trunk vertebrae ~24, predorsal tail vertebrae ~94.

COLOUR. Dorsal surface pale greyish blue, semi-translucent, with pale cloudy areas on posterior disc margins. Ventral surface similar to dorsal surface, mainly pale greyish blue, with whitish areas around mouth, on snout, pelvic anterior lobes, pectoral posterior margins, cloaca and tail.

SIZE. Only known from a juvenile male 42 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean; Broken Ridge. Demersal, possibly on hard bottoms at ~1050 m depth. Probably more widespread on this submarine ridge and those adjacent. Biology unknown.

SIMILAR SPECIES. Rarely caught skate, known from a single juvenile specimen; the combined pale greyish blue coloration on both surfaces of the disc, and a moderately long and extremely slender tail, are distinctive.

LONGLOBE VELVET SKATE

20.77

Notoraja longiventralis Séret & Last, 2012

NE

IDENTIFICATION. Medium-sized skate with a velvety, heart-shaped disc, very long and slender tail, rudimentary thorn before each eye but no other enlarged thorns on head or tail, and upper and lower disc similarly dark. Disc weakly undulate anteriorly, probably more so in adults, broader than long; apex broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with small triangular lobe at tip. Eye rather small, orbit length 2.6–3.3 in snout length, 1.1–1.2 times interorbital space. Mouth rather broad, arched slightly, nasal flaps with widely separated lobes, lacking dermal fringe; tooth rows in upper jaw ~38. Both surfaces of disc and tail densely covered with fine bristle-like denticles giving skin a velvety feel. Preorbital thorn obscure; form of alar and malar patches unknown; thorns on tail rudimentary. Tail very narrow-based, oval in cross-section, very thin towards its tip, length 1.5–1.6 times precloacal length; lateral folds confined to posterior half of tail, not greatly expanded near tail tip. Pelvic-fin margins very deeply notched, anterior lobe much longer than posterior lobe. Dorsal fins small, flag like, tall, well separated, procaudal length longer than snout length; caudal-fin upper lobe tall, much longer than second dorsal-fin base. Pectoral-fin radials 64–65. Predorsal vertebrae 72–79, abdominal vertebrae 26–27, predorsal tail vertebrae 98–106.

COLOUR. Dorsal and ventral surfaces both dark purplish grey; faint white spots scattered over pores along the anterior margins of ventral disc.

SIZE. Attains at least 43 cm TL; young hatch at ~17 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; Fiji and Vanuatu. Demersal on mid-insular slopes at 660–955 m depths. Known from few specimens and nothing known of its life history.

SIMILAR SPECIES. Largely similar to other velvet skates, but differs mainly in its coloration and unusually long and pointed anterior pelvic-fin lobes.

PALE SKATE

20.78

Notoraja ochroderma McEachran & Last, 1994

DD

IDENTIFICATION. Small skate with a velvety, heart-shaped disc, long slender tail, no thorn on head and disc, except alar thorns in adult males, 2–3 rows of small thorns on tail, and plain pale yellowish, almost translucent, on both surfaces of disc. Disc ~1.2 times broader than long; anterior margins undulate, outer corners broadly rounded. Snout short with firm rostral cartilage, with short fleshy lobe and flexible at its tip. Eye moderate-sized, orbit length 3.3–3.9 in snout length, 0.8–1.2 in interorbital space. Mouth rather broad, arched, nasal flaps broadly lobed, posterior margin smooth; tooth rows in upper jaw 44–49. Dorsal surface of disc and tail densely covered with fine bristle-like denticles giving skin a velvety feel; entire ventral surface smooth. Tail narrow-based, oval in cross-section, tapering gently to its tip, length 1.3 times precloacal length; lateral folds indistinct. Pelvic-fin margins deeply notched. Dorsal fins small, lanceolate, connected or slightly separated at base, caudal-fin upper lobe very low, barely distinguishable, connected to second dorsal-fin base. Pectoral-fin radials 75–84. Predorsal vertebrae 72–82, trunk vertebrae 30–32, predorsal tail vertebrae 117–119.

COLOUR. Dorsal surface plain pale yellow, margins almost translucent. Ventral surface pale, translucent; pores not pigmented. Tail with dark band through base of second dorsal fin.

SIZE. Attains at least 37 cm TL; males mature at ~35 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off north-eastern Australia. Demersal on continental slope at 350–445 m depths. Biology unknown.

SIMILAR SPECIES. Resembles the Australian Ghost Skate (20.74) as both species have plain pale dorsal and ventral surfaces. However, the Ghost Skate, which occurs off Western Australia, has a velvety tail lacking thorns and its tail undersurface is prickly.

SAPPHIRE SKATE

20.79

Notoraja sapphira Séret & Last, 2009

DD

IDENTIFICATION. Small skate with a velvety, heart-shaped disc in adult males, long slender tail, very small pre-orbital thorn, no other thorns on head or disc, dorsal surface rich blue and ventral surface brownish black. Disc ~1.1 times broader than long; anterior margins undulate in adult males, regularly convex in females, outer corners broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with short triangular fleshy projection at tip. Eye moderate-sized, orbit length 2.6–3.9 in snout length, 0.8–1.3 in interorbital space. Mouth rather narrow, slightly arched, nasal flaps broadly lobed, posterior margin coarsely fringed; tooth rows in upper jaw 29–36. Dorsal surface largely free of dermal denticles, prickly on mid-dorsal trunk and on tail; mid-dorsal thorn row on tail hardly distinct from the rest of dense prickles pattern; ventral surface of disc and tail smooth. Tail narrow-based, depressed over length, slightly convex ventrally, tapering posteriorly, very slender near tip, length 1.3–1.4 times precloacal length; lateral folds extending almost along whole tail length. Pelvic-fin margins deeply notched. Dorsal fins short and moderately tall, somewhat lanceolate, generally separated slightly at base; caudal-fin upper lobe well developed, separated from and distinctly longer than second dorsal-fin base. Pectoral-fin radials 67–70. Predorsal vertebrae 70–74, trunk vertebrae 23–25, predorsal tail vertebrae 126–134.

COLOUR. Dorsal surface plain rich blue, outer margins of disc narrowly dark-edged. Ventral surface dark brown or brownish black, outer margins darker; whitish areas around mouth corners, nasal lobes and cloaca.

SIZE. Attains at least 41 cm TL; smallest mature male 36 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; New Zealand to New Caledonia (Coral and Tasman Seas). Demersal on mid-insular slopes along Norfolk Ridge, at 1195–1315 m depths. Biology unknown.

SIMILAR SPECIES. Resembles the Blue Skate (20.72) from southern Australia in its striking blue dorsal coloration. The Blue Skate has small, dark flecks scattered over the disc, only 1 postorbital thorn, and the tail thorns are larger and arranged in rows.

BLOTCHED SKATE

20.80

Notoraja sticta McEachran & Last, 2008

LC

IDENTIFICATION. Medium-sized skate with a velvety, heart-shaped disc in adult males, long slender tail, small preorbital and postorbital thorns, but no other enlarged thorns on head or disc, and large greyish brown blotches on both surfaces of disc. Disc 1.1–1.2 times broader than long; anterior margins undulate, mostly concave in adult males, convex in females; outer corners very broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with distinct fleshy lobe at tip. Eye moderate-sized, orbit length 2.6–3.1 in snout length, ~1.3 times interorbital space. Mouth rather broad, arched, nasal flaps broadly lobed, posterior margin smooth; tooth rows in upper jaw 32–41. Dorsal surface mostly smooth, dermal denticles on anterior head in females; ventral surface smooth. Tail with several regular rows of thorns, but almost without denticles. Tail narrow-based, oval to slightly depressed in cross- section, tapering gently to its tip, length ~1.2 times precloacal length; lateral folds well developed posteriorly. Pelvic-fin margins deeply notched. Dorsal fins small, lanceolate, close together; caudal-fin upper lobe low and separated from second dorsal-fin base. Pectoral-fin radials 65–68. Predorsal vertebrae 72–82, trunk vertebrae 25–27, predorsal tail vertebrae 97–101.

COLOUR. Dorsal surface white with large, greyish brown blotches, often concentrated on central disc. Ventral surface similar to dorsal surface, with blotches covering more of disc. Tail pale dorsally, dark ventrally.

SIZE. Attains at least 63 cm TL; males mature at ~52 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean; Great Australian Bight (off southern Australia). Demersal on continental slope at 820–1200 m depths. Rarely caught and few individuals exist in museum collections. Biology unknown.

SIMILAR SPECIES. The only Australian *Notoraja* skate with a distinctive dark, mottled colour pattern on both surfaces of the disc. May occur in deeper parts of the Great Australian Bight.

LEADHUE SKATE

20.81

Notoraja tobitukai (Hiyama, 1940)

DD

IDENTIFICATION. Small skate with a rough, heart-shaped disc, long tail, no thorns on head or along mid-disc, and plain dorsal coloration. Disc rounded in young, becoming more undulate in adults, barely broader than long (~1.05 times longer); apex broadly rounded. Snout moderately elongate, flexible, lacking firm rostral cartilage, with small fleshy lobe at tip. Eye large, orbit length ~2.8–2.9 in snout length, 1.3–1.5 times interorbital space. Mouth rather broad, nasal flaps broadly lobed, lacking obvious dermal fringe; tooth rows in upper jaw 35–40. Upper disc and tail uniformly covered with spiny denticles, long and sparse on disc; ventral surface of disc smooth, tail with short spiny denticles. Alar thorns in adult male and up to 7 irregular dense rows of prickly thornlets on tail, no other thorns on body. Tail slender, oval in cross-section, tapering gently to its tip, its length ~1.2 times precloacal length; lateral folds most prominent on posterior tail. Pelvic-fin margins very deeply notched, anterior lobe often as long as posterior lobe. Dorsal fins small, tilted, separated slightly or bases joined, procaudal length almost equal to preoral length; caudal-fin upper lobe rather well developed. Pectoral-fin radials 60–63. Predorsal vertebrae 84–90, abdominal vertebrae 24–26, predorsal tail vertebrae 60–64.

COLOUR. Uniform greyish blue or greyish brown above, caudal and dorsal fins darker. Undersurface largely greyish and somewhat mottled; belly and mouth usually paler.

SIZE. Attains at least ~51 cm TL; males still immature at 31 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Taiwan to southern Japan. Demersal on continental and insular slopes, at 60–1015 m depths. Although considered rare in Japanese seas, caught often in deep water off Taiwan. Little known of its life history.

SIMILAR SPECIES. Two forms of this skate exist in the North-West Pacific, based on molecular data. However, morphological differences distinguishing these forms have not yet been found.

ALLEN'S SKATE

20.82

Pavoraja alleni McEachran & Fechhelm, 1982

LC

IDENTIFICATION. Small skate with a circular to heart-shaped disc covered above with granular denticles, short snout, nuchal and orbital thorns present, long slender tail with thorns before first dorsal fin absent or much smaller than those anteriorly, and largely yellowish brown, sometimes with faint dusky blotches. Disc heart-shaped in adult males, more circular in females and young. Snout very flexible, lacking a continuous rostral cartilage, its length 2–3.3 times orbit length; interorbital space narrow, 1.1–1.6 in orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 33–40. Dorsal disc and tail uniformly granular (only anterior lobe of pelvic fin naked); 1–6 nuchal thorns, 2–8 orbital thorns, adults with 1–4 prominent scapular thorns, malar thorn patch small, small alar thorns usually in 1–3 rows; tail thorns long, in 3 rows, lateral rows usually absent in juveniles; ventral surface entirely smooth. Tail elongate and slightly depressed, its length ~1.1–1.3 times precloacal length; lateral folds widening toward tail tip. Pelvic-fin margin very deeply concave. Dorsal fins small, low, separated by a base length or less; caudal fin low. Pectoral-fin radials 64–66. Predorsal tail vertebrae 73–79, abdominal vertebrae 25–26.

COLOUR. Uniformly yellowish to pale brown above in adults, usually with a scattering of large, darker brownish blotches (appearing as narrow bands on tail) in young; dorsal fins dusky, caudal fin pale to dusky, lateral folds dark posteriorly. Ventral surface off-white or greyish brown; outer edge of disc not conspicuously darker.

SIZE. Attains ~35 cm TL. Males mature at 29–32 cm TL; young hatch at ~11 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off north-western Australia. Demersal on upper continental slope at 305–460 m depths. Caught commonly as bycatch and discarded. Nothing known of its biology.

SIMILAR SPECIES. Similar to the Australian Sandy Skate (20.83), which has a more southerly distribution in Australian seas. Two morphologically distinguishable forms occur off Western Australia.

AUSTRALIAN SANDY SKATE

20.83

Pavoraja arenaria Last, Mallick & Yearsley, 2008

DD

IDENTIFICATION. Small skate with a circular to heart-shaped disc covered above with granular denticles, short snout, nuchal and orbital thorns present, long slender tail with thorns before first dorsal fin similar in size to those anteriorly, and uniformly yellowish dorsal coloration. Disc heart-shaped in adult males, more circular in females and young. Snout very flexible, lacking a continuous rostral cartilage, its length 2.2–3.1 times orbit length; interorbital space narrow, 1.4–1.7 in orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 33–42. Dorsal disc and tail uniformly granular (only anterior lobe of pelvic fin naked); 2–3 small nuchal thorns, 1–2 thorns above front and back of orbit, no scapular thorns, very small malar thorns, small alar thorns usually in 1 row; tail thorns long, in 3 widely spaced rows; ventral surface entirely smooth. Tail variably elongate and slightly depressed, its length ~0.8–1.3 times precloacal length; lateral skin fold widening toward tail tip. Pelvic-fin margin very deeply concave. Dorsal fins small, low, about a base length apart; caudal fin small. Pectoral-fin radials 73–77. Predorsal tail vertebrae 65–72, abdominal vertebrae 26–29.

COLOUR. Uniformly pale yellowish to pinkish above, anterior lobes of pelvic fins, median region of snout, and pored prenuchal area slightly paler; dorsal and caudal fins dusky. Ventral surface uniformly white, outer corners of disc and apical part of tail often greyish.

SIZE. Attains at least 34 cm TL; males mature at ~29–33 cm TL.

HABITAT AND BIOLOGY. South-East Indian Ocean; off southern Australia. Demersal on outer continental shelf and upper slope at 190–710 m depths, but more typically in 300–400 m. Nothing known of its life history.

SIMILAR SPECIES. Similar to Allen's Skate (20.82), but it has more pectoral-fin radials, and thorns preceding the first dorsal fin are typical of those on the rest of the tail rather than reduced or missing.

MOSAIC SKATE

20.84

Pavoraja mosaica Last, Mallick & Yearsley, 2008

LC

IDENTIFICATION. Very small skate with a circular to heart-shaped disc covered above with granular denticles, short snout, inconspicuous orbital thorns, no nuchal thorns, long slender tail, and distinctive pattern of fine reticulations and spots on dorsal surface. Disc heart-shaped in adult males, more circular in females and young. Snout very flexible, lacking a continuous rostral cartilage, its length 2.8–3.1 times orbit length, interorbital space narrow, 1.3–1.7 in orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 37–47. Dorsal disc and tail uniformly granular (only anterior lobe of pelvic fin naked); 1–3 very small preorbital thorns, 0–2 at postorbit; no nuchal or scapular thorns; small malar thorns, small alar thorns in 2–3 rows; tail thorns small, usually in 3 rows, lateral rows missing in young; ventral surface entirely smooth. Tail elongate and slightly depressed, its length ~0.9–1.1 times precloacal length; lateral folds well developed posteriorly. Pelvic-fin margin very deeply concave. Dorsal fins very small, low, connected at base; caudal fin small. Pectoral-fin radials 71–74. Predorsal tail vertebrae 72–76, abdominal vertebrae 29–31.

COLOUR. Dorsal surface pale with a dense pattern of fine darker brownish reticulations and spots, preorbital snout and posterior margin paler than rest of disc; dorsal fins light brown with pale margins; caudal fin and anterior lobe of pelvic fin pale. Ventral surface usually uniformly white, outer margins of disc sometimes greyish.

SIZE. Attains ~28 cm TL; smallest mature male 27 cm TL, and smallest postnatal juvenile 8 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off Queensland (Australia). Demersal on continental slope at 300–490 m depths. Life history unknown.

SIMILAR SPECIES. Belongs to a group of small Australian deepwater skates, but no other member of the genus has such a strikingly beautiful coloration.

PEACOCK SKATE

20.85

Pavoraja nitida (Günther, 1880)

LC

IDENTIFICATION. Small skate with a circular to heart-shaped disc covered above in granular denticles, short snout, nuchal and orbital thorns present, and a brownish dorsal surface with clusters of white spots. Disc heart-shaped in adult males, more circular in females and young. Snout very flexible, lacking a continuous rostral cartilage, its length ~1.8–2.4 times orbit length; interorbital space ~1.5–1.8 in orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 32–35. Dorsal disc and tail uniformly granular (only anterior lobe of pelvic fin naked); 1–5 nuchal thorns; orbital thorns enlarged, 2–3 at both front and back of orbit; scapular thorns sometimes present; tail thorns rather large, in 3 main rows (additional lateral rows sometimes near tail base); malar thorn patch extending well forward on disc; ventral surface entirely smooth. Tail elongate and slightly depressed, its length ~0.9–1.2 times precloacal length; lateral folds widening toward tail tip. Pelvic-fin margin very deeply concave. Dorsal fins small, low, less than a base length apart; caudal fin small. Pectoral-fin radials 70–74. Predorsal tail vertebrae 62–70, abdominal vertebrae 26–30.

COLOUR. Upper surface medium to dark brown with poorly defined clusters of small whitish spots; ventral surface usually uniformly white, sometimes with greyish outer corners of disc; no dark-edged pores, dorsal and caudal fins yellowish or brownish.

SIZE. Attains at least 37 cm TL. Both sexes mature at ~30–33 cm TL; young hatch at ~8 cm TL.

HABITAT AND BIOLOGY. South-West Pacific and South-East Indian Ocean; South Australia to New South Wales (Australia). Demersal along mid-continental shelf and upper slope at 30–450 m depths. Biology not well known. Discarded bycatch of local trawl fisheries.

SIMILAR SPECIES. Most similar to a tropical Australian relative, the False Peacock Skate (20.86), which has white spots that are not arranged in well-defined clusters and more vertebrae.

FALSE PEACOCK SKATE

20.86

Pavoraja pseudonitida Last, Mallick & Yearsley, 2008

LC

IDENTIFICATION. Small skate with a circular to heart-shaped disc covered above in granular denticles, rather short snout, nuchal and orbital thorns present, and a pattern of randomly arranged white spots rather than spots forming distinct clusters. Disc heart-shaped in adult males, more circular in females and young. Snout very flexible, lacking a continuous rostral cartilage, its length ~2.3–3.1 times orbit length; interorbital space ~1.4–2 in orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 38–46. Dorsal disc and tail uniformly granular (only anterior lobe of pelvic fin naked); 0–5 nuchal thorns but typically 2–3 in adults; 3–10 large orbital thorns forming rosette in adults; scapular thorns rarely present; tail thorns rather large, in 3 widely spaced rows decreasing in size and density posteriorly; malar thorn patch very extensive; ventral surface entirely smooth. Tail elongate and slightly depressed, its length ~0.9–1.3 times precloacal length; lateral folds widening toward tail tip. Pelvic-fin margin very deeply concave. Dorsal fins small, low, interspace narrow but fins rarely connected; caudal fin low. Pectoral-fin radials usually 72–75. Predorsal tail vertebrae 76–81, abdominal vertebrae 26–30.

COLOUR. Yellowish above, usually densely covered with small, regularly spaced and non-clustered white spots; dorsal fins mostly pale anteriorly, dark posteriorly; caudal fin paler than dorsal fins. Ventral surface usually uniformly white.

SIZE. Attains at least 37 cm TL; smallest mature male 32 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off Queensland (Australia). Demersal on upper continental slope at 210–510 m depths. Biology unknown.

SIMILAR SPECIES. Shares a similar body shape and white-spotted pattern with another member of the genus *Pavoraja*, a cold-water species, the Peacock Skate (20.85), but unlike this species its spots are not arranged in distinctive clusters.

DUSKY SKATE

20.87

Pavoraja umbrosa Last, Mallick & Yearsley, 2008

LC

IDENTIFICATION. Small skate with a circular to heart-shaped disc covered above with granular denticles, short snout, nuchal and orbital thorns present, long slender tail, and uniform greyish dorsal coloration. Disc heart-shaped in adult males, more circular in females and young. Snout very flexible, lacking a continuous rostral cartilage, its length 2.1–2.6 times orbit length; interorbital space 1.6–2 in orbit length. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 36–42. Dorsal disc and tail uniformly granular (only anterior lobe of pelvic fin naked); 3–4 prominent nuchal thorns; 2–4 large preorbital and 1–4 postorbital thorns; no scapular thorns; malar thorn patch extending well forward of 1–3 rows of small alar thorns; tail thorns rather large, in 3 widely spaced rows, poorly developed near dorsal fins; ventral surface entirely smooth. Tail long, narrow and slightly depressed, its length ~1–1.3 times precloacal length; lateral folds well developed posteriorly. Pelvic-fin margin very deeply concave. Dorsal fins small, low, barely connected; caudal fin small. Pectoral-fin radials 68–71. Predorsal tail vertebrae 74–83, abdominal vertebrae 27–30.

COLOUR. Plain greyish to greyish brown above, occasionally with weak mottling or diffuse dark brown blotches; dorsal fins generally dusky, caudal fin pale. Ventral surface usually pale, frequently dusky on central and outer corners of disc.

SIZE. Attains ~37 cm TL. Males mature at ~32–35 cm TL, smallest juvenile 8 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New South Wales (eastern Australia). Demersal on upper continental slope at 360–730 m depths. Biology not well known. Discarded bycatch of local trawl fisheries.

SIMILAR SPECIES. Similar to the Australian Sandy Skate (20.83), but has fewer pectoral-fin radials, its upper surface is greyish rather than yellowish, and tail thorns preceding the first dorsal fin are typically less well developed.

BLOTCHED SANDSKATE

20.88

Psammobatis bergi Marini, 1932

LC

IDENTIFICATION. Medium-sized skate with a rounded to weakly heart-shaped disc, snout short and flexible anteriorly due to very delicate rostral cartilage, nasal folds large and fringed, skin rough, and strong dorsal pattern of blotches and reticulations. Disc almost circular, becoming weakly heart-shaped in adult males, 1.1–1.2 times broader than long; apex broadly rounded. Snout soft, tip blunt and sometimes with small filament at tip; length 2.5–2.8 times orbit length, interorbital space 1.1–1.3 in orbit length. Mouth narrow, nasal flaps very broadly lobed, strongly fringed; tooth rows in upper jaw 39–46. Upper disc rough with scattered, coarse denticles in juveniles, becoming denser on anterior half of disc and trunk in adults; undersurface smooth. Thorns forming rosette on orbit and triangular patch over nape-shoulder region; alar thorns in long narrow band; median row of thorns from nape to first dorsal fin (sometimes interrupted on anterior trunk in adults); tail with 2–4 parallel irregular rows. Tail depressed and rather broad, barely tapering, its length 1.1–1.4 times precloacal length; lateral folds narrow. Pelvic-fin margin deeply incised. Dorsal fins small, tilted, confluent, near tip of tail; caudal fin minute. Pectoral-fin radials ~68. Predorsal tail vertebrae 59–61.

COLOUR. Dorsal surface medium to dark brown, dappled with pattern of pale blotches, reticulations, spots and irregular bars; tail with alternating light and dark saddles and blotches. Ventral surface entirely white; no dark-edged pores.

SIZE. Attains ~61 cm total length. Males mature at 39–50 cm TL, females 36–46 cm TL; egg cases ~4 cm long.

HABITAT AND BIOLOGY. South-West Atlantic; southern Brazil to northern Argentina. Demersal on inner continental shelf at 10–80 m depth. Diet consists mainly of crustaceans, but also polychaetes and small bony fishes.

SIMILAR SPECIES. No other member of the genus *Psammobatis* has a complex dorsal colour pattern, consisting of pale spots, reticulations, blotches, bars and saddles, on a dark upper surface.

ZIPPER SANDSKATE

20.89

Psammobatis extenta (Garman, 1913)

LC

IDENTIFICATION. Small skate with a heart-shaped disc, snout short and flexible anteriorly due to very delicate rostral cartilage, nasal folds large and fringed, skin rough, and dorsal surface usually with fine spots and reticulations. Disc width 1.1–1.3 times length; anterior margins undulate, apex broadly rounded. Snout soft, broad, tip bluntly rounded, usually with minute filament at tip; length usually 2–3.1 times orbit length, interorbital space 0.6–1 times orbit length. Mouth narrow, nasal flaps very broadly lobed, strongly fringed; tooth rows in upper jaw 34–50. Upper disc uniformly granular, anterior and posterior edges of disc and posterior lobes of pelvic fin covered with long thornlets in adults; uniquely within genus, clasper tip of mature males set with denticles; undersurface smooth. Thorns forming dense rosette on orbit rim and distinct triangular patch over nape-shoulder region; irregular median row of ~50 thorns from nape to first dorsal fin (number increasing with growth); tail with irregular parallel dorsolateral rows. Tail depressed and rather slender, tapering gradually, its length 1.3–1.5 times precloacal length; lateral folds narrow. Pelvic-fin margin deeply incised. Dorsal fins small, low, confluent or separated slightly with 0–3 interdorsal thorns, near tip of tail; caudal fin short, upper caudal lobe rather well developed. Pectoral-fin radials ~61–66. Predorsal tail vertebrae 52–62.

COLOUR. Dorsal disc reddish brown to greyish brown, with indistinct pale blotches and dense pattern of tiny dark spots and reticulations; spots usually forming faint rosettes and weak pectoral markings sometimes present. Ventral surface entirely whitish; no dark-edged pores.

SIZE. Attains ~35 cm in both sexes. Males mature at ~26–27 cm TL, females 24–26 cm TL. Young hatch at ~6 cm TL; egg cases ~3 cm long.

HABITAT AND BIOLOGY. South-West Atlantic; southern Brazil to Patagonia (southern Argentina). Demersal on continental shelf at 15–160 m depths. Reproduces probably all year round. Diet consists mainly of crustaceans, and occasionally small quantities of polychaetes and cnidarians.

SIMILAR SPECIES. Similar to the Spade Sandskate (20.94), but with denticles bordering the clasper groove, different colour and thorn patterns, fewer upper-jaw tooth rows, and more predorsal tail vertebrae.

FRECKLE SANDSKATE

20.90

Psammobatis lentiginosa McEachran, 1983

DD

IDENTIFICATION. Medium-sized skate with a weakly rhombic to heart-shaped disc, snout short and flexible anteriorly due to very delicate rostral cartilage, nasal folds large and fringed, skin largely rough, and dorsal surface with numerous scattered black spots. Disc width ~1.1–1.2 times length; anterior margins undulate, apex broadly rounded. Snout soft, tip blunt and rarely with small filament at tip; length 1.8–3.1 times orbit length, interorbital space 0.7–0.9 times orbit length. Mouth narrow, nasal flaps very broadly lobed, strongly fringed; tooth rows in upper jaw 35–49. Upper disc more or less evenly covered with denticles in juveniles; adults with pectoral centres largely smooth, and coarse denticles or small thornlets on anterior and posterior disc margins, and in band on mid-disc; undersurface smooth. Thorns forming rosette on orbit and triangular patch over nape-shoulder region; median row of thorns extend from anterior trunk to first dorsal fin, flanked by 1 (juveniles) or up to 3 parallel thorn rows in adults. Tail rather slender, tapering strongly, its length 1.3–1.6 times precloacal length; lateral folds narrow. Pelvic-fin margin deeply incised. Dorsal fins small, low, confluent or separated slightly, fins located near tip of tail; upper caudal lobe rather well developed. Pectoral-fin radials ~67. Predorsal tail vertebrae 63–70.

COLOUR. Upper surface medium to pale brown, with numerous scattered blackish spots (often clustered in circles with brownish centres). Undersurface white, sometimes with irregular brown blotches on disc margins, pelvic fins and tail; no dark-edged pores.

SIZE. Attains ~55 cm TL. Both sexes mature at ~30–34 cm TL; egg cases ~4 cm long.

HABITAT AND BIOLOGY. South-West Atlantic; southern Brazil to Argentina. Demersal on continental shelf at 30–170 m depths; more common in northern sector. Diet consists primarily of crustaceans and polychaetes; small cephalopods and fishes consumed occasionally.

SIMILAR SPECIES. Most closely resembles the smaller Spade Sandskate (20.94), which has an indistinct dorsal colour pattern and more tooth rows in the upper jaw (exceeding 50 rows).

SHORTFIN SANDSKATE

20.91

Psammobatis normani McEachran, 1983

DD

IDENTIFICATION. Medium-sized skate with a heart-shaped disc, snout short and flexible anteriorly due to very delicate rostral cartilage, nasal folds large and fringed, skin largely smooth in adults, and dorsal surface plain or with small dark spots. Disc width ~1.1–1.2 times length; anterior margins strongly undulate, apex broadly rounded. Snout soft, tip blunt, obtuse and often with small filament at tip; length 1.9–2.9 times orbit length, interorbital space 0.9–1.1 times orbit length. Mouth rather broad, nasal flaps very broadly lobed, strongly fringed; tooth rows in upper jaw 33–44. Upper disc sparsely covered with denticles in juveniles; adults largely smooth, with fine denticles only along anterior disc margin and its mid-line; undersurface entirely smooth. Thorns forming rosette on orbit and not forming obvious triangular patch over nape-shoulder region (4–5 nuchal and suprascapular thorns, and 3 on each shoulder); 3–5 rows of tail thorns in adults, median row extends from posterior trunk to first dorsal fin. Tail rather slender, tapering slightly, its length 1–1.2 times precloacal length; lateral folds narrow. Pelvic-fin margin deeply incised. Dorsal fins small, low, mostly separated slightly, fins located near tip of tail; caudal fin very low and short. Pectoral-fin radials ~67. Predorsal tail vertebrae 52–58.

COLOUR. Upper surface colour uniformly brownish, with or without small, indistinct dark spots on disc and pelvic fins; undersurface uniformly white; no dark-edged pores.

SIZE. Attains ~58 cm TL. Males mature at 41–56 cm TL, females 39–51 cm TL. Egg cases 4–5 cm long.

HABITAT AND BIOLOGY. South-West Atlantic and South-East Pacific; Uruguay to Argentina, also off southern Chile. Demersal on continental and insular shelves and upper slopes at 30–360 m depths. Diet consists mainly of crustaceans and polychaetes.

SIMILAR SPECIES. Resembles the Raspthorn Sandskate (20.95), but differs in clasper morphology, body shape ratios, upper caudal-fin lobe less well developed, and no obvious triangular thorn patch on the nape-shoulder region.

SMALLTAIL SANDSKATE

20.92

Psammobatis parvacauda McEachran, 1983

DD

IDENTIFICATION. Small skate with a weak heart-shaped disc, snout short and flexible anteriorly due to very delicate rostral cartilage, nasal folds large and fringed, rather short tail, skin largely smooth in adults, and dorsal surface brownish with faint pale blotches. Disc width ~1.1–1.2 times length; anterior margins weakly undulate, apex broadly rounded. Snout soft, tip blunt, obtuse and no filament at tip; length 1.6–2.3 times orbit length, interorbital space 0.7–0.9 times orbit length. Eyes very large, orbit length 5.6–6.7% of TL. Mouth rather small, nasal flaps broadly lobed, fringed; tooth rows in upper jaw ~37–38. Upper disc largely smooth, with denticles only along anterior and posterior disc margins and on mid-disc; undersurface entirely smooth. Thorns not forming rosette on orbit and not forming obvious triangular patch over nape-shoulder region (3 nuchal, 2 suprascapular, and 2 thorns on each shoulder); 3 irregular rows of tail thorns in adults; median tail row extends from tail base to first dorsal fin, lateral thorns much smaller than median thorns. Tail rather slender and short, tapering strongly, its length ~0.9–1 times precloacal length; lateral folds narrow. Pelvic-fin margin deeply incised. Dorsal fins small, low, joined at bases, fins very near tip of tail; caudal fin very short, upper lobe moderately well developed. Pectoral-fin radials ~70–71. Predorsal tail vertebrae 51–58.

COLOUR. Dorsal surface brownish, with pattern of small faint whitish blotches. Undersurface whitish; no dark-edged pores.

SIZE. At least 36 cm TL (based on one non-type specimen).

HABITAT AND BIOLOGY. South-West Atlantic; off Falkland Islands and northern Argentina. Demersal on outer continental and insular shelves at 120–130 m depths. No information on life history available.

SIMILAR SPECIES. Very poorly known and its distinction from some sandskates has been questioned. However, based on its relatively large eyes, compared to other members of the genus, we provisionally consider it to be valid.

SMALLTHORN SANDSKATE

20.93

Psammobatis rudis Günther, 1870

DD

IDENTIFICATION. Medium-sized skate with a heart-shaped disc, snout short and flexible anteriorly with delicate rostral cartilage, nasal folds large and fringed, and dorsal surface usually with strong pattern of blotches and spots. Disc width ~1.1–1.2 times length; anterior margins undulate in adult males, apex broadly rounded. Snout soft, tip blunt, obtuse and often with small filament at tip; length 2.4–3.3 times orbit length, interorbital space 1–1.1 times orbit length. Mouth narrow, nasal flaps long and broadly lobed, strongly fringed; tooth rows in upper jaw 31–37. Upper disc more or less evenly covered with coarse denticles in young; in adults, pectoral centres become smooth and mid-disc and anterior and posterior disc margins become rougher, with coarser denticles and small thornlets; undersurface smooth. Thorns forming rosette on orbit, several on nape and 1 on each shoulder; irregular median row of small thorns in shallow groove from mid-disc to first dorsal fin, no parallel rows on tail. Tail slender, tapering slightly, its length 1.1–1.2 times precloacal length; lateral folds narrow. Pelvic fins large, margins deeply incised. Dorsal fins small, upright, bases usually joined, fins located near tip of tail; caudal fin very low and short. Pectoral-fin radials ~71. Predorsal tail vertebrae 54–57.

COLOUR. Dorsal surface coloration highly variable, usually brownish with symmetrical pattern of pale cloudy blotches and small spots (often also with darker blotches and spots); pectoral markings weak; adult males often with black snout. Undersurface white with dusky posterior disc margins; no dark-edged pores.

SIZE. Attains ~53 cm TL. Both sexes mature at ~36–46 cm TL; egg cases ~5 cm long.

HABITAT AND BIOLOGY. South-West Atlantic and South-East Pacific; Uruguay to southern Chile. Demersal on continental shelf and upper slope at 30–475 m depths. Diet consists mainly of crustaceans, and rarely polychaetes, molluscs and small fishes.

SIMILAR SPECIES. The Raspthorn Sandskate (20.95) has finer denticles and larger tail thorns distributed in more rows.

SPADE SANDSKATE

20.94

Psammobatis rutrum Jordan, 1891

DD

IDENTIFICATION. Small skate with a weakly heart-shaped disc, snout rather short and flexible anteriorly with delicate rostral cartilage, nasal folds large and fringed, and brownish dorsal surface covered with darker pattern of fine spots and reticulations. Disc width ~1.2 times length; anterior margins more undulate in adult males, apex broadly rounded. Snout soft, tip blunt, obtuse and usually with small filament at tip; length 2.4–3.3 times orbit length, interorbital space 1–1.1 times orbit length. Mouth narrow, nasal flaps broadly lobed, strongly fringed; tooth rows in upper jaw 43–66, usually more than 50. Upper disc more or less evenly covered with fine denticles in young; in adults, pectoral centres become smooth and denticles concentrated on mid-disc and anterior and posterior disc margins; undersurface smooth. Thorns forming rosette on orbit and obvious triangular patch over nape-shoulder region; up to 5 median rows of small thorns from nape to first dorsal fin. Tail slender, tapering slightly, rather long, its length 1.2–1.4 times precloacal length; lateral folds narrow. Pelvic fins large, margins deeply incised. Dorsal fins small, low, not connected, fins located near tip of tail; upper caudal lobe well developed. Pectoral-fin radials ~67. Predorsal tail vertebrae 48–51.

COLOUR. Upper surface plain brownish or covered with fine brownish or blackish spots forming dense pattern of reticulations and small ocellate markings. Undersurface uniformly white; no dark-edged pores.

SIZE. Attains ~32 cm TL. Males mature at ~24–26 cm TL; egg cases very small, ~3 cm long.

HABITAT AND BIOLOGY. South-West Atlantic; southern Brazil to Argentina. Demersal on inner continental shelf at 30–150 m depths. Biology little known, diet probably consists primarily of small crustaceans and polychaetes.

SIMILAR SPECIES. Another very small species, the Zipper Sandskate (20.89), has a pricklier dorsal disc, fewer than 50 tooth rows in the upper jaw, and numerous dark and light spots arranged in clusters on the upper surface.

RASPTHORN SANDSKATE 20.95

Psammobatis scobina (Philippi, 1857)

DD

IDENTIFICATION. Medium-sized skate with a heart-shaped disc, snout rather short and flexible anteriorly with delicate rostral cartilage, nasal folds large and fringed, and brownish dorsal surface often covered irregularly with paler and/or darker spots. Disc very broad, width 1.2–1.4 times length; anterior margins strongly undulate in adult males, apex broadly rounded. Snout soft, tip blunt, obtuse and usually with minute filament at tip; length 2.1–2.6 times orbit length, interorbital space 0.8–1.1 times orbit length. Mouth rather broad, nasal flaps broadly lobed, strongly fringed; tooth rows in upper jaw 33–47. Upper disc more or less evenly covered with fine denticles in young; in adults largely smooth, denticles confined to anterior half and mid-disc; undersurface smooth. Thorns forming more or less complete rosette on orbit but without obvious triangular patch over nape-shoulder region; usually 1 parallel row of small thorns on each side of disc mid-line; tail with median row of ~20 thorns and 2–4 irregular parallel rows in adults. Tail slender, tapering slightly, rather long, its length 1.1–1.3 times precloacal length; lateral folds narrow. Pelvic fins large, margins deeply incised. Dorsal fins small, low, bases joined or narrowly separated, fins located near tip of tail; caudal fin very low and short. Pectoral-fin radials ~66. Predorsal tail vertebrae 53–59.

COLOUR. Dorsal surface uniformly brown, with or without small light or dark spots scattered over disc. Undersurface whitish; no dark-edged pores.

SIZE. Attains ~50 cm TL. Matures at ~43–49 cm TL; egg cases ~5 cm long.

HABITAT AND BIOLOGY. South-East Pacific; Chile and possibly off Patagonia. Demersal on continental shelf and slope at 30–450 m depths. Diet unknown, but probably consists of crustaceans, polychaetes, molluscs and small fishes.

SIMILAR SPECIES. The Smallthorn Sandskate (20.93) has much coarser dorsal denticles and smaller median thorns that lie in a detectable groove.

FANFIN SKATE

20.96

Pseudoraja fischeri Bigelow & Schroeder, 1954

DD

IDENTIFICATION. Medium-sized, rather unusual skate with a heart-shaped disc, extremely large pelvic fins comprised of single laterally directed lobe, very long tail with enlarged caudal fin, no dorsal fins, and largely plain pale upper and lower surfaces of disc. Disc width ~1.2 times length; anterior margins concave beside eye; apices broadly rounded. Snout with filamentous tip; soft and flexible vertically due to very delicate rostral cartilage; length 1.8–2.1 times orbit length, interorbital space 0.6–0.7 times orbit length; anterior pectoral-fin radials extending nearly to snout tip. Mouth narrow, nasal flaps very long and broadly lobed; tooth rows in upper jaw 28–30. Skin entirely granular on upper surface, apart from pelvic fins; undersurface of disc entirely smooth except posterior tail covered with granular denticles. Orbit with ~4 large recurved thorns, not forming a rosette; ~3 nuchal and ~2 shoulder thorns; ~26–32 thorns in median row on trunk and tail, regularly spaced, upright; smaller thornlets along lateral margins of tail. Tail slender, slightly depressed, tapering to apex, length 1.3–1.6 times precloacal length; lateral folds confined to posterior third of tail; caudal-fin enlarged, clearly longer than orbit, upper lobe only slightly longer than lower lobe. Pelvic fins greatly enlarged, almost equal to ventral head length; apices broadly rounded, posterior margins transverse; clasper of male unknown. Pectoral-fin radials 84–85. Vertebrae to tail tip 100–106; abdominal vertebrae 35–38, total tail vertebrae 69–74.

COLOUR. Dorsal surface pale brown to grey, with scattering of spots; dark pores on disc margin, beside spiracles and on nuchal region. Undersurface greyish with white mouth; rows of dark pores on head.

SIZE. Attains at least 58 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Florida to Panama, including Caribbean islands. Demersal on continental and insular slopes at 410–575 m depths. Little known and no adult males observed.

SIMILAR SPECIES. No other skate has very broad, single-lobed pelvic fins and a very elongate tail lacking dorsal fins.

DAPPLEBELLY SKATE

20.97

Rhinoraja kujiensis (Tanaka, 1916)

LC

IDENTIFICATION. Large heavy-bodied skate with a rhombic disc, skin on upper surface granular, very short snout, median thorns extending from nuchal region onto tail, 2 strong thorns on each shoulder, and plain coloured above with blotchy ventral pattern. Disc anterior margins straight to undulate anteriorly, apices narrowly rounded. Snout broad with a rounded tip; soft and flexible vertically due to very delicate rostral cartilage; length ~2.3–4.5 times orbit length in adults; interorbital space narrower than orbit in young, slightly broader than orbit in adults; anterior pectoral radials extending to nearly snout tip. Mouth rather small, nasal flaps broadly lobed. Thorns absent from orbit and snout; 32–45 strong thorns in median row on disc and tail before dorsal fins. Upper surface of disc and tail covered with star-shaped denticles, more obviously concentrated along mid-line in adults; undersurface smooth. Tail thickened, dome-shaped in cross-section, tapering to apex, slightly longer than disc length; lateral folds restricted to posterior tail; 2 small dorsal fins at rear of tail barely separated; caudal fin short. Pelvic fin weakly notched, posterior lobe somewhat enlarged, much longer than anterior lobe; clasper slender. Abdominal vertebrae 33–38, predorsal tail vertebrae 76–83.

COLOUR. Upper surface plain yellowish, becoming greyish in preservative, dorsal fins similar to disc; ventral surface of disc mainly white, often with darker blotches near gills and on tail; sensory pores not marked black.

SIZE. Attains at least 104 cm TL; egg cases ~11 cm long.

HABITAT AND BIOLOGY. North-West Pacific; eastern Japan to Sea of Okhotsk (Russia). Demersal on upper and mid-continental and insular slopes at depths of 450–1000 m or more. Bycatch of trawl fishery for cod and rockfishes.

SIMILAR SPECIES. Aspects of squamation are similar to the Aleutian Skate (20.8), but the Dapplebelly Skate has a much shorter snout and differs subtly in morphology and meristics.

WHITEBELLY SKATE

20.98

Rhinoraja longicauda Ishiyama, 1952

LC

IDENTIFICATION. Medium-sized, heavy-bodied skate with a broadly heart-shaped disc, very short snout, long tail, rather large eyes, granular dorsal disc, no shoulder thorns, median thorn row not continuous between nuchal region and posterior disc, and faint spotted pattern above. Disc anterior margins undulate anteriorly with deep concavity beside spiracle; apices broadly rounded. Snout with narrow pointed tip; soft and flexible vertically due to very delicate rostral cartilage; length 1.9–2.9 times orbit length in adults; interorbital space narrower than orbit length; anterior pectoral radials extending to nearly snout tip. Nasal flaps broadly lobed. Thorns absent from orbit, snout and shoulder; 1–4 (mostly 3) nuchal thorns; 18–23 strong, regularly spaced thorns in median row on posterior disc and tail before dorsal fins. Upper surface of disc and tail covered with both large and small denticles, generally denser through middle of disc than on pectoral fin adjacent; undersurface smooth. Tail thickened, dome-shaped in cross-section, tapering to apex, considerably longer than disc length; lateral folds confined to posterior tail; 2 very small dorsal fins together near tail tip; caudal fin rudimentary. Pelvic fin strongly notched, posterior lobe large, clasper slender. Abdominal vertebrae 30–32, predorsal tail vertebrae 74–80.

COLOUR. Upper surface greyish purple, covered with dense pattern of darker brownish spots, a white patch at front of each orbit; becoming plain greyish brown in preservative; ventral surface of disc mainly white, often with darker markings along disc margin, and near cloaca and tail base; sensory pores not marked black.

SIZE. Attains ~69 cm TL. Males smaller, to ~62 cm TL; egg cases ~6–7 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off eastern Japan. Demersal on upper insular slopes at 300–1000 m depths. Caught as bycatch of trawl fishery for cod and rockfishes.

SIMILAR SPECIES. Similar to Oda's Skate (20.99), but has a more broadly heart-shaped disc and fewer vertebrae.

ODA'S SKATE 20.99

Rhinoraja odai Ishiyama, 1958

LC

IDENTIFICATION. Small to medium-sized skate with a subcircular to heart-shaped disc, short snout, very large eyes, long tail, dorsal disc granular with central band of enlarged denticles, no thorns on disc, and a complex pattern of dark spots and white blotches dorsally. Disc heart-shaped in adult males (more subcircular in young); anterior margins undulate anteriorly with deep concavity beside spiracle in adult males; apices broadly rounded. Snout with narrow pointed tip; soft and flexible vertically due to very delicate rostral cartilage; length ~2.2–2.4 times orbit length; interorbital space narrower than orbit; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps lobed. Thorns absent from disc; 8–21 small, irregularly spaced thorns in median row on tail before dorsal fins. Entire upper surface and fins (except most of pelvic fins) covered with denticles; in young, denticles enlarged slightly over middle of disc; adult males with broad band of much larger thornlets from orbital region to anterior tail; undersurface smooth, without denticles. Tail rather stout, depressed, tapering to apex, considerably longer than disc length; lateral folds weak, restricted to posterior tail; 2 small dorsal fins together near tail tip (procaudal length short, subequal to snout length); caudal fin rudimentary. Pelvic fin strongly notched, posterior lobe large, clasper slender. Abdominal vertebrae 33–36, predorsal tail vertebrae 85–91.

COLOUR. Upper surface yellowish to brownish with strong pattern of darker brown spots (similar to size of pupil) and several white pectoral ocelli. Ventral surface white, often with dusky markings on tail; sensory pores not marked black.

SIZE. Attains at least 60 cm TL. Males mature at ~48 cm TL; egg cases ~6 cm long.

HABITAT AND BIOLOGY. North-West Pacific; off eastern Japan. Demersal on continental slope at 300–870 m depths. Narrow-ranging and endemic to Japan.

SIMILAR SPECIES. Resembles the Whitebelly Skate (20.98) from Japanese seas, but lacks prominent nuchal thorns and has more complex dorsal markings.

RIO SKATE

20.100

Rioraja agassizi (Müller & Henle, 1841)

VU

IDENTIFICATION. Medium-sized skate with a rhombic disc, broad and moderately elongate snout, smooth skin, very small eyes, dorsal fins well forward on tail, and upper disc brownish and usually with faint pectoral markings. Disc 1.2 times wider than long, anterior margins undulate (more so in adult males); apices abruptly angular. Snout obtuse, blunt, small triangular lobe at tip; rostral cartilage rigid though narrow, snout not flexible vertically; length 4.4–5.9 times orbit length, interorbital space 1.7–2.5 times orbit length; anterior pectoral radials falling well short of snout tip. Mouth of moderate width, nasal flaps broadly lobed and expanded. Upper and lower surfaces without denticles. Orbit with 3 thorns (1 on preorbit, postorbit and beside spiracle); 21–57 small thorns in single row from nape to first dorsal fin (often reduced on trunk); no malar thorns. Tail very slender (length ~1.1 times precloacal length), tapering evenly, with lateral folds along entire length. Two small, upright dorsal fins, well separated (procaudal length up to twice length of snout); postdorsal tail very long and fleshy, lacking obvious caudal fin. Pelvic fin moderately notched; clasper slender with pointed tip.

COLOUR. Upper surface pale to medium brownish; pectoral marking a dark brown blotch (often encircled by paler ring); disc weakly marbled with usually faint dark spots and blotches; narrow dark bands on tail, most pronounced near dorsal fins. Undersurface white; sensory and mucous pores marked with black streaks and spots.

SIZE. Attains ~71 cm TL. Males mature at 42–52 cm TL, females 50–58 cm TL; egg cases 4–6 cm long.

HABITAT AND BIOLOGY. South-West Atlantic; Brazil to northern Argentina. Demersal on continental shelf and upper slope at 5–600 m depths. Reproduces throughout year. Diet consists mainly of small crustaceans, but also small bony fishes.

SIMILAR SPECIES. No other South-West Atlantic skate has such a long procaudal tail lacking an obvious upper caudal-fin lobe and with very widely separated dorsal fins.

BIGNOSE FANSKATE

20.101

Sympterygia acuta Garman, 1877

VU

IDENTIFICATION. Small skate with a heart-shaped disc, very long and narrowly pointed snout, largely smooth skin, very small eyes, outer margin of pelvic fins only weakly indented, and plain brownish dorsal surface. Disc usually longer than wide, anterior margins deeply concave beside spiracles (more so in adult males); apices broadly rounded. Snout greatly extended, triangular, tip narrowly rounded; soft and flexible vertically due to very delicate rostral cartilage, length more than 10 times orbit length; interorbital space ~3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw 31–38. No thorns on shoulders, around eyes or in malar region; ~21 thorns in single row from nape to first dorsal fin. Upper surface smooth, except for densely prickled anterior disc margins, and sides of tail from hind disc onward. Ventral surface smooth, except for snout and prickly anterior disc margins. Tail broad based, tapering evenly, slightly shorter than disc; 2 small dorsal fins at rear of tail, barely separated; clasper very broad. Caudal fin long and low. Pelvic fin weakly notched, lobes not clearly separated when fin spread wide; clasper robust with pointed tip. Pectoral-fin radials ~72. Predorsal vertebrae ~90, abdominal vertebrae ~29, predorsal tail vertebrae ~61.

COLOUR. Upper disc plain, light to medium brown with rostral triangle translucent; thorns whitish. Ventrally largely white, with darker disc margins and dark brown blotches on tail.

SIZE. Attains ~62 cm TL; matures at ~45–48 cm TL. Egg cases small, ~5 cm long; young hatch at ~8 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; northern Argentina to Brazil. Demersal inshore on sandy habitats in surf zone, to depths of ~190 m. Females deposit egg cases throughout year (often in clusters attached to surf-aggregated debris), with a peak in winter. Diet consists of polychaetes, shrimps, and also small molluscs and bony fishes.

SIMILAR SPECIES. A South-West Atlantic relative, the Smallnose Fanskate (20.102), has a shorter snout and richer dorsal colour pattern.

SMALLNOSE FANSKATE

20.102

Sympterygia bonapartii Müller & Henle, 1841

DD

IDENTIFICATION. Medium-sized skate with a very broad heart-shaped disc, rather short and broad snout, largely smooth skin, very small eyes, outer margin of pelvic fins straight or barely indented (when expanded), and pale brownish and usually with groups of darker spots on dorsal surface. Disc width 1.4 or more times length, anterior margins almost straight; apices broadly rounded. Snout bluntly angular, tip triangular; soft and flexible vertically due to very delicate rostral cartilage, length 3.8–5.2 times orbit length; interorbital space 1.3–2.2 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw ~35. Single preorbital and postorbital thorns; row of 2–6 median thorns on nape, continuous along disc to tail (or discontinuous on mid-disc); ~14 thorns on mid-line of tail; 1 interdorsal thorn; no thorns on shoulders or in malar region. Upper disc largely smooth, except for prickly anterior margins and head; ventral surface smooth. Tail short and firm, slightly longer than precloacal length; narrow-based (width similar to interorbital space); 2 small dorsal fins near tip of tail, narrowly separated. Caudal fin low. Pelvic fins weakly notched. Pectoral-fin radials ~81. Predorsal vertebrae ~94, abdominal vertebrae ~35, predorsal tail vertebrae ~60.

COLOUR. Dorsal surface of disc brownish, mostly pale, with variable pattern of darker brown blotches; often with pale spots and lines forming reticulate pattern; snout tip usually with black blotch. Undersurface white, with black blotch on snout tip and tail tip.

SIZE. Attains ~88 cm TL; matures at ~58–60 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic (Patagonia to southern Brazil) and South-East Pacific (Strait of Magellan). Demersal, coastal and inner continental shelf (usually shallower than 100 m), occasionally to 500 m depths. Diet consists mainly of decapod crustaceans, and small bony fishes when adult.

SIMILAR SPECIES. Occurs in the South-West Atlantic with the Bignose Fanskate (20.101), which has a much more elongated and narrowly pointed snout.

SHORTTAIL FANSKATE

20.103

Sympterygia brevicaudata (Cope, 1877)

DD

IDENTIFICATION. Medium-sized skate with a broad heart-shaped to weakly rhombic disc, short and broad snout, largely smooth skin, small eyes, outer margin of pelvic fins weakly indented (when expanded), and dorsal surface brownish and covered with dense pattern of darker blotches (often faint). Disc width ~1.2 times length, anterior margins undulate; apices narrowly rounded. Snout rounded, soft and flexible vertically due to very delicate rostral cartilage, length 2.4–2.9 times orbit length; interorbital space 1.2–2 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth broad, nasal flaps broadly lobed; tooth rows in upper jaw ~31–39. Usually single preorbital and postorbital thorns; median row of thorns discontinuous on mid-disc; 10–17 thorns on posterior trunk and mid-line of tail; 1 interdorsal thorn; no thorns on shoulders or in malar region. Both surfaces of disc largely naked apart from scattered denticles. Tail short and firm, slightly longer than precloacal length in adults; narrow-based (width much narrower than interorbital space); 2 well-developed dorsal fins near tip of tail, narrowly separated; clasper slender with pointed tip, reaching to near base of first dorsal fin. Caudal fin minute. Pelvic fins weakly notched. Pectoral-fin radials 70–75. Predorsal vertebrae ~78, abdominal vertebrae 28–33, predorsal tail vertebrae 45–51.

COLOUR. Dorsal surface yellowish brown to greyish brown, usually with faint pattern of dark and/or light blotches; dark markings cloudy (similar size to pupil) and sometimes indistinct. Undersurface white.

SIZE. Attains ~55 cm TL; males mature at 35–40 cm TL.

HABITAT AND BIOLOGY. South-East Pacific; Ecuador to southern Chile. Demersal, coastal inshore and on inner continental shelf to ~100 m depths. Diet consists of small benthic crustaceans and polychaete worms.

SIMILAR SPECIES. The Filetail Fanskate (20.104), which occurs with the Shorttail Fanskate in the South-East Pacific, has the dorsal fins connected at their bases and lacks thorns on the upper disc.

FILETAIL FANSKATE

20.104

Sympterygia lima (Poeppig, 1835)

DD

IDENTIFICATION. Medium-sized skate with a broad heart-shaped and thornless disc, broad snout, small eyes, outer margin of pelvic fins noticeably concave (when expanded), dorsal fins joined at bases, and dorsal surface uniformly brownish or with faint blotchy pattern. Disc width 1.2–1.3 times length, anterior margins undulate; apices narrowly rounded. Snout short, rounded, tip bluntly angular, soft and flexible vertically due to very delicate rostral cartilage, length 3.1–4 times orbit length; interorbital space 1.4–2.3 times orbit length; anterior pectoral radials extending to nearly snout tip. Mouth narrow, nasal flaps broadly lobed; tooth rows in upper jaw ~37. No thorns on disc; ~10 thorns in single row on tail. Skin largely naked; dorsal surface with scattered denticles on head and along disc mid-line. Tail short and firm, subequal to precloacal length; narrow-based (width similar to interorbital space); 2 small dorsal fins forward of tip of tail, bases joined; clasper slender with pointed tip, reaching to near base of second dorsal fin. Caudal fin short. Pelvic fins weakly notched and lobes not clearly separated when fin spread wide. Pectoral-fin radials ~68. Predorsal vertebrae ~79, abdominal vertebrae ~30, predorsal tail vertebrae ~49.

COLOUR. Greyish brown above, uniform or with darker and lighter blotches; often with random circular black spots on disc and pelvic fins; snout beside rostral cartilage pale, translucent; tail usually with broad dark and light crossbars and few dark spots. Undersurface whitish.

SIZE. Attains ~65 cm TL. Males mature at ~45 cm TL, females at ~51 cm TL.

HABITAT AND BIOLOGY. South-East Pacific; off Chile. Demersal, coastal inshore and on inner continental shelf to 80 m depths. Feeds on small benthic crustaceans and polychaete worms.

SIMILAR SPECIES. The Shorttail Fanskate (20.103), which also occurs in the South-East Pacific, has thorns on the upper disc, and the dorsal fins are separate (not joined at their bases) with a thorn in the intervening space.

21

PYGMY SKATES

Family Gurgesiellidae

S. Weigmann, B. Séret, P.R. Last & J.D. McEachran

Pygmy skates are very small to small rays (adults from 23 cm to 59 cm TL) with a flattened body, rhombic to heart-shaped disc, pectoral-fin apices angular to rounded, snout short or moderately elongate and pointed (sometimes with a small triangular process), and the tail is firm, slender and long to very long. The family is represented by 3 genera, *Cruriraja*, *Fenestraja* and *Gurgesiella*, and includes 19 species. Pygmy skates have been classified in separate families, or with hardnose skates (Rajidae), and the snout varies from rigid to semi-rigid, with the rostral cartilage incomplete distally and the anteriormost pectoral-fin radials approaching the snout tip in 2 genera. New information from DNA analysis has shown that the gurgesiellid genera are distinct from other skate genera and warrant placement together in a separate family. Their pelvic fins are deeply notched with long, finger-like anterior lobes (lobes fused in *Gurgesiella*). Like in other skates, the anterior nasal flaps are expanded to form an incomplete nasal curtain. These flaps usually reach the mouth but their posterior margins are not joined like in some other ray groups. The tail usually has 2 small dorsal fins, but species of *Gurgesiella* have either 1 or none. A very small caudal fin is present near the tail tip. Skin on the dorsal surface is variably covered with small denticles, and the distribution pattern of thorns varies between genera and species. Rostral thorns are mostly present in *Cruriraja* but absent in *Fenestraja*. Thorns are usually present on the orbital rims, nuchal region, and in a median row on the trunk and tail in *Cruriraja* and *Fenestraja*, but mostly absent (or as thornlets) in *Gurgesiella* species. Malar and alar thorns are present in adult males in all 3 genera. Pygmy skates live mostly in deep water on continental and insular slopes to 1095 m depth, but have been caught inshore at 40 m depth. Species have limited distributions in warm temperate and tropical seas of the Pacific, Atlantic and Indian Oceans. Primarily benthic, they most likely use their finger-like, anterior pelvic-fin lobes to walk on the seafloor. Pygmy skates feed on a variety of small bottom-dwelling invertebrates and fishes. All species are oviparous.

KEY TO GURGESIELLID GENERA

1. Disc rhombic (fig. 1) with short flat triangular projection at snout tip; pelvic fins with 1 laterally directed lobe (fig. 4); 1 or no dorsal fins; thorns mostly absent (or rather thornlets); amphi-American .... ***Gurgesiella* (3 species; fig. 1, pp. 491–493)**

   Disc rhombic (fig. 2) or heart-shaped (fig 3); pelvic fin with distinct anterior and posterior lobes (figs 5, 6); 2 dorsal fins; thorns usually present on orbital rims, nuchal area and in a median row on trunk and tail 2

2. Disc typically rhombic in shape, without projection at snout tip; rostral thorns usually present; anterior and posterior lobes of pelvic fin distinctly separate, anterior lobe finger-like (fig. 5); Atlantic and Indian Oceans .... ***Cruriraja* (8 species; fig. 2, pp. 475–482)**

   Disc typically heart-shaped, with small triangular rostral process at snout tip; no rostral thorns; anterior and posterior lobes of pelvic fin continuous, connected by series of radials and fin membranes (fig. 6); Western Atlantic and Indian Oceans .... ***Fenestraja* (8 species; fig. 3, pp. 483–490)**

fig. 1

fig. 2

fig. 3

fig. 4

fig. 5

fig. 6

pelvic fins (ventral view)

ANDAMAN PYGMY SKATE

21.1

Cruriraja andamanica (Lloyd, 1909)

DD

IDENTIFICATION. Small skate with a broad rhombic disc, short and broadly pointed snout without a filament, large eyes, separate anterior and posterior pelvic-fin lobes, 2 dorsal fins, and numerous rostral thorns. Disc ~1.2–1.3 times broader than long; anterior margins undulate, apex rounded. Preorbital snout length ~2.8–3.2 times interorbital width, ~5.3 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit ~2.1–2.5 times in snout length. Ventral head length ~25% of TL; preoral length ~13–14% of TL. Mouth moderately large, width 5.7–5.8% of TL and 2.2–2.4 times in preoral snout length, with 40–54 tooth rows per jaw. Skin firm and thick, dorsal surface largely covered with small dermal denticles, ~15 large rostral thorns, a continuous rosette of 8 large thorns on each orbital rim but no other thorns between eyes; a median row of large thorns on trunk. Tail long, slender and firm, length ~1.6 times precloacal length, gradually tapering to tip; with median row of thorns and parallel rows of thorns and thornlets; 2 small, barely separated dorsal fins near tail tip; caudal fin reduced to a narrow skin fold on ventral surface; pectoral fin with ~58 radials.

COLOUR. Dorsal surface uniform slate grey, ventral surface uniform slate grey or greyish pink.

SIZE. Attains at least 50 cm TL. Males mature at ~46 cm TL.

HABITAT AND BIOLOGY. Northern Indian Ocean; Andaman Sea and possibly off Indonesia, a record from South-West Indian Ocean requires validation. Demersal on soft bottoms of insular slopes at 275–525 m depth. Probably feeds on benthic invertebrates and small fishes.

SIMILAR SPECIES. Differs from the other *Cruriraja* species of the Indian Ocean, the Hulley's (21.5) and Roughnose (21.6) Pygmy Skates, in having many more rostral thorns, but fewer thorns on the nape-shoulder region and tail.

ATLANTIC PYGMY SKATE

21.2

Cruriraja atlantis Bigelow & Schroeder, 1948

DD

IDENTIFICATION. Small skate with a broad rhombic disc, prickly skin, short and broadly pointed snout without a filament, large eyes, separate anterior and posterior pelvic-fin lobes, 2 widely spaced dorsal fins, 2–3 rows of small rostral thorns, and multiple rows of small thorns on posterior disc and along dorsal surface of tail. Disc ~1.3 times broader than long; anterior margins weakly undulate, apex rounded. Preorbital snout length ~3.7 times interorbital width, ~5.5 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit 1.9–2.1 times in snout length. Preoral length ~12% of TL. Mouth moderately large, width 5.6–6.2% of TL and 2–2.2 times in preoral snout length, with ~40–42 tooth rows per jaw. Skin firm and thick, dorsal surface densely set with dermal denticles, rostral thorn patch distinct; rosette of ~11–12 thorns on each orbital rim but no other thorns between eyes; 1–3 median rows of thorns on trunk, 2–4 stout thorns on shoulders. Tail long, slender and firm, length ~1.6–1.7 times precloacal length, gradually tapering to tip (lateral skin folds broad at rear of tail); in adults, 3–7 dense rows of median thorns along anteriormost part of tail but only 2 or 3 rows approaching first dorsal fin, more widely dispersed over tail in females; numerous small thorns between dorsal fins, interdorsal space 9–11.1% of TL and ~2.5 times first dorsal-fin base length; caudal fin weakly developed. Claspers moderately long (reaching ~2/5 distance from pelvic axils to first dorsal-fin origin) and rather slender in adult male.

COLOUR. Dorsal surface plain pale brown with dusky dorsal and caudal fins. Ventral surface whitish or yellowish, usually with brownish blotches on abdomen, pectorals and pelvic fins (including claspers); tail tip dusky.

SIZE. Attains ~34 cm TL. Males mature at ~28 cm TL. Smallest known juvenile 10 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; off the Bahamas, Cuba and Florida (USA). Demersal on soft bottoms of continental and insular slopes at 510–860 m depths. Probably feeds on benthic invertebrates and small fishes.

SIMILAR SPECIES. Differs from all other *Cruriraja* species in having a particularly wide interdorsal space.

BROADFOOT PYGMY SKATE 21.3

Cruriraja cadenati Bigelow & Schroeder, 1962

DD

IDENTIFICATION. Small skate with a broad rhombic disc, prickly skin, short and broadly pointed snout without a terminal filament, large eyes, separate anterior and posterior pelvic-fin lobes, 2 closely spaced dorsal fins, shoulder thorns, and numerous rostral thorns. Disc ~1.3 times broader than long; anterior margins weakly undulate, apex narrowly rounded. Preorbital snout length ~3.1 times interorbital width, ~5.6 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit ~2.1 times in snout length. Preoral length ~14% of TL. Mouth moderately large, width 6.1% of TL and ~2.3 times in preoral snout length, with ~40–46 tooth rows in each jaw. Skin firm and thick, dorsal surface densely set with dermal denticles. Irregular row of ~10 rostral thorns and rosette of ~11 thorns on each orbital rim (no other thorns between eyes); 5 prominent thorns on mid-line from nuchal to scapular region, thorns absent on mid-back, row of 27–30 closely spaced thorns from level of greatest disc width to slightly posterior to pelvic tips, double row of 32–35 thorns on tail to first dorsal fin plus 1–2 parallel rows of small tail thorns. Tail long, slender and firm, length 1.4–1.6 times precloacal length, gradually tapering to tip; 2 slightly separated dorsal fins (less than half first dorsal-fin base length apart); caudal fin weakly developed. Claspers moderately long (reaching about half distance from pectoral axils to first dorsal-fin origin) and rather slender in adult male.

COLOUR. Dorsal surface light brown, often with numerous dark brown irregular spots; dorsal fins pale or dusky. Ventral surface of disc whitish to pale brownish, posterior margins irregularly greyish; tail white.

SIZE. Attains ~38 cm TL. Male paratype is mature at 35 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; off Puerto Rica and Florida (USA). Demersal on soft bottoms of continental and insular slopes at 455–895 m depths.

SIMILAR SPECIES. Differs from the Rough Pygmy Skate (21.8) in the number and arrangement of thorns on the disc and tail.

SMOOTHNOSE PYGMY SKATE 21.4

Cruriraja durbanensis (von Bonde & Swart, 1923)

DD

IDENTIFICATION. Small skate with a broad weakly rhombic disc, rather short and narrowly pointed snout without a filament, small eyes, separate anterior and posterior pelvic-fin lobes, 2 dorsal fins, shoulder thorns, single median thorn row on disc and tail, and no thorns at snout tip or on rostral ridge. Disc ~1.3 times broader than long; anterior margins weakly undulate, apex broadly rounded. Preorbital snout length ~3.5 times interorbital width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles, orbit ~4 times in snout length. Mouth moderately large, width ~2.3 times in preoral snout length. Skin firm and thick, dorsal surface largely covered with small dermal denticles; an interrupted rosette of 3–8 thorns on each orbital rim but no other thorns between eyes; 1–2 mid-shoulder thorns; continuous median row of thorns extending from nape to mid-length of tail or beyond; no parallel rows of thorns on tail. Tail long, slender and firm, length ~1.4 times precloacal length; gradually tapering to tip; lateral skin folds confined to posterior third of tail. Pelvic-fin anterior lobes very slender. Dorsal fins well separated, without thorns in their interspace; caudal fin weakly developed.

COLOUR. Dorsal and ventral surfaces both reddish brown (in preservative) but this coloration is likely to be artificial; areas around mouth and abdomen whitish in holotype.

SIZE. Attains at least 31 cm TL. Known only from 2 juvenile specimens, both presumed lost.

HABITAT AND BIOLOGY. South-East Atlantic; off South Africa. Poorly known, but considered to be benthic on soft bottoms of mid-continental slope at ~860 m depth. Probably benthic, feeding on benthic invertebrates and small fishes.

SIMILAR SPECIES. Contrary to its scientific name, this skate is not known to occur off Durban, in the South-West Indian Ocean. Differs from all other *Cruriraja* species in having unusually small eyes. Other members of the genus from southern Africa, Hulley's (21.5) and the Roughnose (21.6) Pygmy Skates, have prominent thorns on the snout and multiple rows of tail thorns in adults.

HULLEY'S PYGMY SKATE 21.5

Cruriraja hulleyi Aschliman, Ebert & Compagno, 2010

NE

IDENTIFICATION. Small skate with a broad rhombic disc, short and broadly pointed snout without a filament, large eyes, separate anterior and posterior pelvic-fin lobes, 2 dorsal fins, and rostral thorns few and small. Disc ~1.2 times broader than long; anterior margins weakly undulate, apex angular. Preorbital snout length 2.2–2.8 times interorbital width, 6.4–7.1 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit ~1.7–2.7 times in snout length. Ventral head length ~22–24% of TL; preoral length ~10–12% of TL. Mouth moderately large, width 5.2–6.4% of TL and ~1.9 times in preoral snout length, with 37–47 tooth rows in upper jaw. Skin firm and thick, dorsal surface largely without dermal denticles, ~4–5 small rostral thorns, a rosette of ~9 regularly spaced, large thorns on each orbital rim but no other thorns between eyes; 1–5 median rows of large thorns on trunk. Tail long, slender and firm, length ~1.4–1.7 times precloacal length, gradually tapering to tip; with a median row of 39–47 thorns plus 3–6 interdorsal thorns and 4 parallel thorn rows; 2 separate dorsal fins (1 aberrant specimen with only 1 dorsal fin known); caudal fin weakly developed; pectoral fin with 64–66 radials. Claspers long (postcloacal length ~23% of TL) and thick in adult male.

COLOUR. Dorsal surface usually yellow-brown, with weakly defined darker brown patches in adults; mottled with circular brown spots and brown tail bands in juveniles. Ventral surface uniform yellowish white.

SIZE. Attains 59 cm TL. Males mature at ~45 cm TL, females at ~46–48 cm TL. Smallest known juvenile ~10 cm TL, egg cases ~5 cm long.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; southern Africa, Namibia to Eastern Cape (South Africa). Demersal on continental shelf and upper slope at 40–545 m depths. Benthic feeder, mainly on mysids and other crustaceans; larger prey such as cephalopods and small fishes, important to large skates, are rarely consumed.

SIMILAR SPECIES. Differs from another southern African species, the smaller Roughnose Pygmy Skate (21.6), in having a shorter snout, smaller eyes, more spatulate anterior pelvic-fin lobes, and thorns on the central disc (rather than absent).

ROUGHNOSE PYGMY SKATE 21.6

Cruriraja parcomaculata (von Bonde & Swart, 1923)

NE

IDENTIFICATION. Small skate with a broad rhombic disc, short and broadly pointed snout without a filament, large eyes, separate anterior and posterior pelvic-fin lobes, 2 closely spaced dorsal fins, numerous small rostral thorns, and no thorns on mid-disc and over anterior half of abdomen. Disc ~1.3 times broader than long; anterior margins weakly undulate, apex angular. Preorbital snout length ~1.8–4.3 times interorbital width, ~5.2–6.6 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit ~1.8–2.4 times in snout length. Preoral length ~11–14% of TL. Mouth moderately large, width 5.4–5.6% of TL and 2–2.6 times in preoral snout length, with 30–42 tooth rows per jaw. Skin firm and thick, dorsal surface largely without dermal denticles. Rostral thorns ~12 small; 8–9 regularly spaced thorns in rosette on each orbital rim but no other thorns between eyes; thorns on anterior disc not continuous with those of tail. Tail long, slender and firm, length 1.5–1.9 times precloacal length, gradually tapering to tip; median row of 16–39 thorns plus 1–4 interdorsal thorns and 2 parallel rows of small thorns (usually reduced posteriorly). Two slightly separated dorsal fins (less than half first dorsal-fin base length apart); caudal fin poorly developed.

COLOUR. Dorsal surface brownish, disc with a few dusky blotches to numerous dark spots in juveniles. Ventral surface uniform yellowish white or brownish white.

SIZE. Attains 43 cm TL. Males mature at ~36 cm TL, females ~35 cm TL. Smallest known juvenile ~9 cm TL, egg cases <5 cm long.

HABITAT AND BIOLOGY. South-West Indian Ocean; South Africa and Mozambique. Demersal on outer continental shelf and upper slope at 65–680 m depths. Diet unknown but probably feeds mainly on crustaceans.

SIMILAR SPECIES. Differs from Hulley's Pygmy Skate (21.5) in its smaller size, longer snout, larger eyes, more pointed anterior pelvic-fin lobes, and lacking thorns on the central upper disc.

POEY'S PYGMY SKATE

21.7

Cruriraja poeyi Bigelow & Schroeder, 1948

DD

IDENTIFICATION. Small skate with a broad and largely smooth rhombic disc, short and broadly pointed snout without a filament at its tip, large eyes, separate anterior and posterior pelvic-fin lobes, 2 barely separated dorsal fins, several rostral thorns, and no shoulder thorns. Disc 1.2–1.3 times broader than long; anterior margins weakly undulate, apex narrowly rounded. Preorbital snout length ~3.7 times interorbital width, ~5.2 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit ~2.3 times in snout length. Preoral length ~14% of TL. Mouth moderately large, width 7% of TL and ~2 times in preoral snout length, with 44–50 tooth rows in each jaw. Skin firm and thick, dorsal surface mostly free of denticles; denticles present along dorsal margin of anterior disc and in narrow band from shoulder to tail base. Rostral thorns 5–10; 4–8 thorns in interrupted rosette on each orbital rim (no other thorns between eyes); continuous row of 31–52 thorns from mid-disc to first dorsal fin, adults with up to 6 additional parallel rows of tail thorns; 1–4 interdorsal thorns. Tail long, slender and firm, length 1.3–1.4 times precloacal length, gradually tapering to tip (lateral skin folds broad at rear of tail). Two slightly separated dorsal fins (less than half first dorsal-fin base length apart); caudal fin weakly developed. Claspers short (reaching a distance equal to mouth width beyond pelvic tips) and rather slender in adult male.

COLOUR. Dorsal surface of disc pale brown, covered more or less regularly with dark brown spots (each about half orbit length); tail with 1 or more dark bars and faint spots on dorsal fins (spots and bars most conspicuous in small juveniles); caudal and dorsal fins sometimes partially or entirely black in adults. Ventral surface pale brown with paler and darker mottling; tail paler than disc.

SIZE. Attains ~34 cm TL. Maturity size unknown. Smallest known juvenile ~8 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Florida (USA), Caribbean and Gulf of Mexico. Demersal on soft bottoms of upper continental and insular slopes at 365–870 m depths.

SIMILAR SPECIES. Differs from the Cuban Pygmy Skate (21.10) in having a largely smooth dorsal disc (rather than granular) and more closely spaced dorsal fins.

ROUGH PYGMY SKATE

21.8

Cruriraja rugosa Bigelow & Schroeder, 1958

DD

IDENTIFICATION. Medium-sized skate with a broad, finely granular rhombic disc, short and broadly pointed snout without a filament, large eyes, separate anterior and posterior pelvic-fin lobes, 2 closely spaced dorsal fins, few to several rostral thorns, and nuchal thorns present and well-separated from median thorn row extending along posterior disc and tail. Disc 1.2–1.4 times broader than long; anterior margins weakly undulate, apex rounded. Preorbital snout length 3.2–4.6 times interorbital width, 4.7–5.8 times in disc width; rostral cartilage firm and slender; no obvious lobe at tip. Eyes close to spiracles and large, orbit 2.1–3.7 times in snout length. Preoral length 10–14% of TL. Mouth moderately large, width 4.6–6.3% of TL and 1.8–2.6 times in preoral snout length, with 34–46 tooth rows in each jaw. Skin firm and thick, dorsal surface largely covered with dermal denticles (denticles also on ventral tail in specimens larger than ~25 cm TL). Rostral thorns 1–9; rosette of 3–8 thorns on orbital rim (no other thorns between eyes); usually 2 nuchal thorns; median row of 47 thorns on posterior trunk and tail. Tail long, slender and firm, length 1.3–1.8 times precloacal length, gradually tapering to tip (lateral skin folds broad at rear of tail); without parallel thorn rows; dorsal fins less than half first dorsal-fin base length apart, with 1–3 thorns in interspace; caudal fin weakly developed; pectoral fin with ~59 radials. Claspers moderately long (reaching a distance equal to preorbital length behind pelvic tips) and rather slender in adult male.

COLOUR. Dorsal surface pale brown, caudal and dorsal fins somewhat darker. Ventral surface whitish, sometimes mottled brown; 1 specimen reported to be dark brown on both surfaces of disc.

SIZE. Attains ~51 cm TL. Males mature at ~39 cm TL; smallest known juvenile ~9 cm TL.

HABITAT AND BIOLOGY. Western Central and South Atlantic; Florida (USA) to Brazil, including Caribbean and Gulf of Mexico. Demersal on soft bottoms of continental and insular slopes at 250–1010 m depths.

SIMILAR SPECIES. Differs from other members of the genus *Cruriraja* in having only a single row of enlarged thorns on the dorsal mid-line of the tail and lacking thorns in the scapular region and over the abdomen.

BLACKFIN PYGMY SKATE

21.9

Fenestraja atripinna (Bigelow & Schroeder, 1950)

DD

IDENTIFICATION. Very small skate with a rough, heart-shaped disc (~1.2 times as broad as long), snout short with a small triangular process at tip, anterior and posterior pelvic-fin lobes connected but very deeply notched, no rostral thorns, 7–15 small thorns around orbit and 2–3 beside spiracle, and tail long and slender (~64% TL). Disc thin, anterior margin evenly convex, outer and inner pectoral-fin corners broadly rounded. Preorbital snout length about twice interorbital width; eyes large, horizontal orbit length about twice interorbital width. Tooth rows in upper and lower jaws ~40. Skin of dorsal disc almost entirely and densely set with coarse spinules; tip of upper snout, posterior margins of disc, and ventral surfaces smooth. Row of ~6 nuchal thorns and 2–5 thorns on each shoulder; median row of ~60 small thorns, and lateral row of thornlets on trunk and tail, reducing in size before first dorsal fin. Lateral folds narrow and confined to posterior 2/3 of tail. Pelvic fins large with a slender and pointed anterior lobe, ~3/4 as long as posterior lobe. Dorsal fins small, with rounded apices, both dorsal fins near tail tip and widely spaced. Pectoral-fin radials 62–65.

COLOUR. Dorsal surface uniform pale pinkish brown, clouded with chocolate brown in larger individuals; dorsal fins blackish (pale in young). Plain whitish below.

SIZE. Attains ~29 cm TL. Males mature at ~28–29 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina to southern Florida (USA), off the Bahamas and Cuba. Demersal on upper continental and insular slopes at 365–950 m depths. Biology largely unknown.

SIMILAR SPECIES. Differs from other *Fenestraja* species by its plain pinkish coloration, black dorsal fins and large interdorsal space.

CUBAN PYGMY SKATE 21.10

Fenestraja cubensis (Bigelow & Schroeder, 1950)

DD

IDENTIFICATION. Very small skate with a rough, heart-shaped disc (1.2–1.3 times as broad as long), snout short with small triangular process at tip, anterior and posterior pelvic-fin lobes connected but deeply notched, no rostral thorns, 9–15 small thorns around orbit and 1–2 beside spiracle, and tail long and slender (length 62–65% TL). Disc thin, anterior margin evenly convex, outer and inner pectoral-fin corners broadly rounded; anterior margin more undulate in adult males. Preorbital snout length about twice interorbital width; eyes large, horizontal orbit length ~1.6–1.7 times interorbital width. Tooth rows in upper and lower jaws 38–48. Dorsal disc almost entirely and densely set with coarse spinules, tip of snout and posterior pectoral-fin margins smooth, skin of large specimens smoother than young; ventral surface smooth. Row of ~6–8 nuchal thorns, rosette of 10–15 thorns on each orbital rim, 1–2 thorns on each shoulder; median row of 50–100 small thorns, and a lateral row of thornlets on tail, reducing in size before first dorsal fin. Lateral tail folds narrow and confined to posterior 2/3 of tail. Pelvic fins large with a slender and pointed anterior lobe, length ~3/4 as long as posterior lobe. Dorsal fins small, with rounded apices; dorsal fins positioned near tail tip, bases close together but separated. Pectoral-fin radials 58–59. Predorsal tail vertebrae 64–70.

COLOUR. Dorsal surface pale brown, with cloudy dark brown spots and blotches (variable in size and distribution); pectoral marking usually present as a dark blotch; tail pale brown with 5–6 crossbars, 2 posterior ones crossing dorsal fins. Ventral surface plain pale yellowish.

SIZE. Reported to reach ~30 cm TL, but probably smaller to 23 cm TL. Males mature at 18–21 cm TL. Size at hatching ~7 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; off Cuba, Bahamas and Florida (USA). Demersal on upper continental slope at 310–870 m depths, usually deeper than 440 m. Biology unknown.

SIMILAR SPECIES. Differs from other *Fenestraja* species by an obvious pattern of cloudy, dark brown spots and blotches, and 5–6 dark crossbars on the tail.

PLAIN PYGMY SKATE

21.11

Fenestraja ishiyamai (Bigelow & Schroeder, 1962)

DD

IDENTIFICATION. Very small skate with a heart-shaped disc (about as broad as long), snout moderately long with small triangular process at tip, anterior and posterior pelvic-fin lobes connected but deeply notched, no rostral thorns, series of 6–8 small thorns around orbit and 1 beside spiracle, and tail long and slender (~62% TL). Disc thin, anterior margin evenly convex, outer and inner pectoral-fin corners broadly rounded. Preorbital snout length ~3.5 times interorbital width; eyes large, horizontal orbit length 1.1 times interorbital width. Tooth rows in upper jaw ~34. Dorsal disc almost entirely and densely set with coarse spinules. Row of ~4–5 nuchal thorns, 1 thorn on each shoulder, an irregular median row of small thorns, and 2 lateral rows of thornlets on tail, reducing in size before first dorsal fin. Lateral tail folds narrow and extending from near rear tip of pelvic fins to near tip of tail. Pelvic fins large with a slender and pointed anterior lobe, about as long as posterior lobe. Dorsal fins small, both dorsal fins located near tail tip, confluent at bases or with very short interspace. Pectoral-fin radials 57–61.

COLOUR. Dorsal surface plain greyish brown, ventral surface plain pinkish white.

SIZE. Attains ~36 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Cuba, Bahamas, Nicaragua and Florida (USA). Demersal, continental slope at 505–950 m depths. Biology unknown.

SIMILAR SPECIES. Differs from other *Fenestraja* species by the combination of a plain greyish brown dorsal coloration, and having the anterior and posterior pelvic-fin lobes about equal in length (rather than with the anterior lobe shorter).

MADAGASCAR PYGMY SKATE

21.12

Fenestraja maceachrani (Séret, 1989)

DD

IDENTIFICATION. Small skate with adult size unknown, a heart-shaped disc (~1.2 times as broad as long), snout short and bluntly angled and small triangular process at its tip, anterior and posterior pelvic-fin lobes connected but deeply notched, a few thorns along rostral ridges, patch of 3–6 preorbital thorns, 5–8 small thorns around orbit and 1 near spiracle, and tail long and slender (62–64% TL). Disc thin, anterior margin evenly convex, outer and inner pectoral-fin corners broadly rounded. Preorbital snout length 2.1–2.3 times interorbital width; orbits large, length almost as long as interorbital width. Tooth rows in upper jaw ~39–40. Dorsal disc entirely and densely set with coarse spinules, smooth ventrally. An irregular median row of 7–9 nuchal thorns and 2 thorns on each shoulder; median row of ~80 irregular thorns on trunk and tail from scapula to first dorsal fin, an additional irregular parallel row extends from trunk to tail; tail with a lateral thorn row and 1 interdorsal thorn. Pelvic fins large with a slender anterior lobe, almost as long as posterior lobe. Lateral skin folds broad at rear of tail. Dorsal fins triangular, second dorsal fin smaller and with rounded apices; dorsal fins located near tail tip, with bases separated. Pectoral-fin radials 78–80. Predorsal tail vertebrae 79–84.

COLOUR. Dorsal surface of disc and tail uniformly brownish, often pale. Ventral surface of disc uniform pale whitish, lower surface of tail mottled with faint brownish blotches.

SIZE. Attains at least 42 cm TL; adult males not yet collected.

HABITAT AND BIOLOGY. Western Indian Ocean; off north-western Madagascar. Demersal on upper continental slope at 600–765 m depths. Biology unknown.

SIMILAR SPECIES. In other *Fenestraja* species, the skin of the upper disc is more heavily ornamented with various patterns of blotches and/or is darker in coloration.

PRICKLY PYGMY SKATE

21.13

Fenestraja mamillidens (Alcock, 1889)

DD

IDENTIFICATION. Very small skate with adult size unknown, a rhombic disc (about as broad as long), snout rather short and bluntly angled, without a projection at its tip, anterior and posterior pelvic-fin lobes connected, single thorns on preorbit, postorbit and spiracle, and tail long and slender (~60% TL). Disc thin, anterior margin weakly undulate, outer pectoral-fin corners rounded, inner pectoral corners acutely rounded. Preorbital snout length 3.4 times interorbital width; eyes large, horizontal orbit length as long as interorbital width. Tooth rows in upper jaw ~24. Dorsal disc and tail, and dorsal fins, densely set with coarse spinules, smooth ventrally. Row of 3 nuchal thorns, 2–3 thorns on each shoulder, median row of ~30 thorns on trunk and tail from scapula to first dorsal fin. Pelvic fins large with a slender anterior lobe, almost as long as posterior lobe. Lateral skin folds broad at rear of tail. Dorsal fins with rounded apices, located near tail tip, adjacent to each other but separated by a small space.

COLOUR. Dorsal surface of disc and tail uniformly black; colour of ventral surface unclear but probably also dark.

SIZE. Attains at least 29 cm TL; adult males not yet collected.

HABITAT AND BIOLOGY. Northern Indian Ocean; Gulf of Mannar, off western Sri Lanka. Demersal on mid-continental slope at ~1090 m depth; possibly deeper, beyond present operating limits of local trawlers. Biology unknown as only known specimen (holotype) has been lost.

SIMILAR SPECIES. Distinguishable from the only other member of the genus *Fenestraja* occurring in the Western and Northern Indian Ocean, the Madagascar Pygmy Skate (21.12), by its rhombic disc (rather than heart-shaped), absence of a projection at the snout tip, narrower interdorsal space, and uniform black coloration. More specimens are needed to get a better description of this species.

PLUTO PYGMY SKATE

21.14

Fenestraja plutonia (Garman, 1881)

DD

IDENTIFICATION. Very small skate with a heart-shaped disc (~1.2 times as broad as long), snout short and bluntly angled with small triangular process at its tip, anterior and posterior pelvic-fin lobes connected but deeply notched, rosette of 2–12 small orbital thorns, 1 thorn beside spiracle, and tail long and slender (64–68% TL). Disc thin, anterior margin undulate, more concave at level of spiracles; outer and inner pectoral-fin corners broadly rounded. Preorbital snout length 2–2.6 times interorbital width; orbits very large, horizontal length ~1.5 times as long as interorbital width. Tooth rows in upper jaw 32–34. Dorsal disc densely covered with coarse spinules, except on snout tip and along pectoral-fin posterior margins; skin smooth ventrally. Row of 3–4 nuchal thorns, 2–3 thorns on each shoulder; median row of 45–70 irregular thorns on trunk and tail from scapula to first dorsal fin, reducing in size to first dorsal fin; an additional irregular parallel row of smaller thorns on trunk and tail, and 1–2 lateral rows of thorns on tail. Pelvic fins large, anterior lobe long and slender, length equal to or exceeding length of posterior lobe. Lateral skin folds broad at rear of tail. Dorsal fins similar in shape and size, with rounded apices; dorsal fins located near tail tip, confluent at bases. Clasper of adult male slender, long (reaching behind pelvic tips a distance exceeding prespiracular length).

COLOUR. Dorsal surface of disc pale yellowish brown to greyish brown, covered with dark spots and dark cloudy blotches; 5–7 irregular dark crossbars on tail, final 2 crossing dorsal fins; ventral surface yellowish white.

SIZE. Attains ~27 cm TL. Males are mature at 23 cm TL; smallest known juvenile 13 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina (USA) to Suriname, including Caribbean and parts of Gulf of Mexico. Demersal on upper and mid-continental slope at depths of 295–1025 m. Biology unknown.

SIMILAR SPECIES. Distinguishable from other Western Atlantic *Fenestraja* species by the presence of dark spots and blotches on its disc, dark crossbars on the tail, long pelvic-fin anterior lobes, and confluent dorsal fins.

SIBOGA PYGMY SKATE

21.15

Fenestraja sibogae (Weber, 1913)

DD

IDENTIFICATION. Very small skate with a heart-shaped disc (1.1–1.2 times as broad as long), snout short and bluntly angled with small triangular process at its tip, anterior and posterior pelvic-fin lobes connected but deeply notched, rosette of 16–17 orbital thorns, 3 spiracular thorns, and tail long and slender (60% TL). Disc thin, anterior margin undulate, more concave at level of spiracles; outer and inner pectoral-fin corners broadly rounded. Preorbital snout length 2.4–2.9 times interorbital width; orbits very large, horizontal diameter 1.3–1.5 times interorbital width. Tooth rows in upper jaw ~35–38. Dorsal disc entirely and densely set with coarse spinules, skin entirely smooth ventrally. Patch of ~7 thorns on nape and shoulders, band of median and 2–3 irregular parallel rows of smaller thorns on trunk and tail from scapula to first dorsal fin. Pelvic fins large, anterior lobe slender, ~3/4 length of posterior lobe. Dorsal fins small, located near tail tip, confluent at bases or separated by a very short interspace. Pectoral-fin radials 61–64. Predorsal tail vertebrae 66–71.

COLOUR. Dorsal surface of disc greyish brown with darker blotches and an ocellus-like blotch on centre of pectoral fins; ventral surface plain white.

SIZE. Attains at least 31 cm TL; known from 2 specimens.

HABITAT AND BIOLOGY. Eastern Indian Ocean; Bali Sea (off Indonesia). Demersal on upper insular slopes at ~290 m depth. Biology unknown and more specimens needed.

SIMILAR SPECIES. Only member of the genus *Fenestraja* known to occur in the Eastern Indian Ocean. Also unique within the genus in having a pectoral marking consisting of an ocellus-like blotch.

GULF PYGMY SKATE

21.16

Fenestraja sinusmexicanus (Bigelow & Schroeder, 1950)

DD

IDENTIFICATION. Small skate with a heart-shaped disc (1.1–1.2 times as broad as long), snout obtuse and rather long without a projection at its tip, anterior and posterior pelvic-fin lobes connected but deeply notched, 2 small rostral thorns in young, rosette of 7–11 small orbital thorns and 1 thorn beside spiracle, and tail long and slender (65–67% TL). Disc thin, anterior margin evenly convex in young and becoming slightly undulate in adults; outer and inner pectoral-fin corners rounded. Preorbital snout length 3.3–3.6 times interorbital width; eyes large, horizontal orbit length ~1.3 times as long as interorbital width. Tooth rows in upper jaw 40–46. Dorsal disc densely covered with coarse spinules, skin smooth ventrally. Triangular patch of 8–12 thorns on nape and shoulder; median row of 56–64 irregular thorns on trunk and tail from scapula to first dorsal fin, an additional irregular parallel row of smaller thorns on trunk and tail on each side of median row; thorns of these 3 rows reducing in size before first dorsal fin. Pelvic fins large, anterior lobe long and slender, length equal to or longer than posterior lobe. Dorsal fins similar in shape and size with rounded apices, both dorsal fins located near tail tip, confluent at bases, or separated by interspace equal to ~1/3 first dorsal-fin base. Pectoral-fin radials 57–61.

COLOUR. Dorsal surface of disc brownish purple, with or without irregular dark spots and blotches; ventral surface plain yellowish white.

SIZE. Attains ~36 cm TL. Males mature at ~31–34 cm TL; smallest known juvenile 12 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Florida (USA) to western Venezuela, including Gulf of Mexico and Caribbean. Demersal on continental shelf and slope at 60–1095 m depths. Biology unknown.

SIMILAR SPECIES. Distinguishable from other pygmy skates of the genus *Fenestraja* from the Western Atlantic by the absence of dark crossbars on its tail, and having 3 longitudinal rows of thorns on the trunk and tail.

ATLANTIC FINLESS SKATE

21.17

Gurgesiella atlantica (Bigelow & Schroeder, 1962)

DD

IDENTIFICATION. Medium-sized plain-coloured skate with a very broad rhombic to heart-shaped disc (width 1.4–1.7 times length), rather short and obtuse snout with a narrow rostral cartilage, large eyes, single-lobed pelvic fins, very long tail without dorsal fins, and caudal fin long with well-developed upper and lower lobes. Disc mid-anterior margin concave, deepest in adult males; pectoral-fin apices somewhat angular. Snout tip with very small flat protuberance; snout length ~2–2.4 times orbit length; interorbital space slightly shorter than orbit length; nasal curtain long with large lobes. Mouth strongly arched; tooth rows in upper jaw 26–44. Dorsal disc entirely covered with fine denticles with stellate bases, more obvious in large individuals; ventral surface prickly over tail and central disc but smooth toward pectoral-fin margins. Adult males with alar thorns and broad band of sharp malar thorns along anterior disc margin, but thorns otherwise absent; large females with small thorns along mid-line of disc and tail. Tail extremely slender, almost filamentous (length ~1.9–2 times precloacal length), with narrow lateral skin folds. Pelvic fins long, anterior and posterior lobes fused, extended laterally and pointed. Caudal fin well developed, lower lobe almost as large as upper lobe. Pectoral-fin radials 71–75. Precaudal tail vertebrae 92–97. Claspers of adult male long and slender (reaching beyond pelvic-fin tips a distance equal to head length).

COLOUR. Disc uniformly pale brown or irregularly blotched; tail darker brown to banded; caudal fin usually black. Ventral surface of disc brownish and pink, sensory pores not evident.

SIZE. Attains ~52 cm TL. Males mature at ~39 cm TL, females 44 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Nicaragua to northern Brazil. Demersal in deep water on continental slope at 245–960 m depths. Life history unknown.

SIMILAR SPECIES. The unusual disc shape with an especially long tail lacking dorsal fins makes this species immediately recognisable from other Atlantic skates.

ONEFIN SKATE

21.18

Gurgesiella dorsalifera McEachran & Compagno, 1980

VU

IDENTIFICATION. Medium-sized blotched skate with a broad rhombic to heart-shaped disc (width 1.4–1.6 times length), rather short and obtuse snout with narrow rostral cartilage, large eyes, single-lobed pelvic fins, very long tail with 1 dorsal fin, and prominent caudal fin. Disc mid-anterior margin concave, not noticeably more concave in adult males; pectoral-fin apices narrowly rounded to angular. Snout tip with small protuberance; snout length ~2–2.8 times orbit length; interorbital space usually shorter than orbit length; nasal curtain long with large lobes. Mouth strongly arched; tooth rows in upper jaw 25–45. Dorsal disc covered with fine denticles with stellate bases, thicker along mid-disc; ventral surface and pelvic fins without denticles. Adult male with alar thorns and broad band of sharp malar thorns along anterior disc margin; 2 irregular rows of thorns on either side of mid-line of tail and additional lateral row. Tail extremely slender, almost filamentous (length ~1.6–2.1 times precloacal length), with lateral skin folds expanded toward tail tip. Pelvic fins long, anterior and posterior lobes fused, extended laterally and bluntly pointed. Caudal fin with obvious upper and lower lobes. Pectoral-fin radials 70–73. Precaudal tail vertebrae 108–114. Claspers of adult male long and very slender (reaching beyond pelvic-fin tips a distance slightly exceeding dorsal head length).

COLOUR. Disc pale brownish, covered with large, indistinct brownish blotches; blotches irregularly shaped and evenly spaced; 6–8 blotches on tail; dorsal and caudal-fins dark brown. Ventral surface whitish, disc margins brownish; sensory pores not evident.

SIZE. Attains ~53 cm TL. Males mature at ~38–42 cm TL, females 37 cm TL.

HABITAT AND BIOLOGY. South-West Atlantic; off northern and southern Brazil. Demersal on continental slope at 400–800 m depths. Life history unknown.

SIMILAR SPECIES. Only member of this small group of unusually long and thin-tailed skates with a single dorsal fin. Other members of the genus lack dorsal fins.

DUSKY FINLESS SKATE

21.19

Gurgesiella furvescens de Buen, 1959

LC

IDENTIFICATION. Medium-sized, plain-coloured skate with a broad rhombic to heart-shaped disc (width 1.5–1.6 times length), very short and extremely obtuse snout with narrow rostral cartilage, large eyes, single-lobed pelvic fins, very long tail without dorsal fins, and well-developed caudal fin with deep upper and lower lobes. Disc mid-anterior margin concave, very deep in adult males; pectoral-fin apices somewhat angular. Snout tip with short flat protuberance; snout length ~1.6–2 times orbit length; interorbital space subequal to orbit length; nasal curtain long with large lobes. Mouth strongly arched; tooth rows in upper jaw 27–43. Dorsal disc surface covered sparsely with fine granular denticles; adult male with alar thorns and narrow band of sharp malar thorns along anterior disc margin; ventral surface smooth. No other thorns on disc or tail. Tail extremely slender (length ~1.6 times precloacal length), narrow based, with well-developed lateral skin folds near its tip. Pelvic fins long, anterior and posterior lobes fused, extended laterally and pointed. Caudal-fin lower lobe well developed, almost as large as upper lobe. Pectoral-fin radials 66–69. Precaudal tail vertebrae 92–97. Claspers of adult male extremely long and slender (reaching beyond pelvic-fin tips a distance well exceeding dorsal head length).

COLOUR. Disc uniformly greyish to dark brownish black above, tips of pelvic fins paler. Ventral surface of disc white with a narrow black posterior margin, sensory pores not evident; tail dark brown.

SIZE. Attains ~57 cm TL. Males mature at ~51 cm TL, females 55 cm TL.

HABITAT AND BIOLOGY. South-East Pacific; known distribution patchy, off northern Peru and Chile. Demersal in deep water on continental slope at 300–960 m depths. Life history unknown.

SIMILAR SPECIES. A characteristic body shape, long tail lacking dorsal fins, and single-lobed pelvic fins, distinguish this species from all other Pacific skates.

22

LEGSKATES

Family Anacanthobatidae

B. Séret, P.R. Last, S. Weigmann & M.F.W. Stehmann

Legskates are small to medium-sized rays (adults from 29 cm to 75 cm TL) with a strongly flattened, rounded to heart-shaped disc, pectoral fins broadly rounded, and a more or less elongated pointed snout, sometimes with a thin filament or leaf-like appendage at its tip. The tail is short, very slender, lacks dorsal fins, and has a very small to barely detectable caudal fin. Pelvic fins consist of 2 separate lobes; finger-like anterior lobes resemble 'legs' and are often much longer than the posterior lobes. The posterior lobes are connected for their full length to the tail in most females. Like in other skates, the anterior nasal flaps are expanded to form an incomplete nasal curtain. These flaps usually reach the mouth but their posterior margins are not joined like in some other ray groups. Skin loose, fleshy and without denticles, apart from a few thornlets on the tail of juveniles in 1 species. No thorns on the body, except for alar thorns in adult males. The internal and external structures of the adult male clasper differ greatly between species. The family includes 13 species in 5 genera: *Anacanthobatis*, *Indobatis*, *Schroederobatis*, *Sinobatis* and *Springeria*. Some of these species were only recently named and some former subgenera have now been upgraded to genera, based mainly on the structure of their claspers. Legskates live mostly in deepwater on continental and insular slopes, between depths of 150 and 1725 m. They occur in warm temperate and tropical seas, in the Western Central Atlantic, South-West Indian Ocean and Indo–West Pacific, and most species have limited distributions. They are bottom-dwellers, using their 'legs' to walk on the seafloor, but have been also observed from submersibles swimming actively well above the seafloor. Diet consists primarily of benthic invertebrates and small fishes. Surprisingly, relatively large bony fishes have been found in the stomachs of legskates. All species are oviparous. Legskates are rarely encountered as they are caught infrequently in trawls and live well beyond depths accessible to most humans.

KEY TO ANACANTHOBATID GENERA

The diagnoses of the 5 genera and 13 species of the family Anacanthobatidae are based largely on clasper anatomy (external components and cartilages) so a simple and reliable practical generic key cannot be constructed. Instead, the following geographical based groupings are provided to assist readers identify the species:

Western Central Atlantic (*Schroederobatis americana*, *Springeria folirostris* and *Springeria longirostris*)

Western Indian Ocean (*Anacanthobatis marmorata*, *Indobatis ori* and *Sinobatis brevicauda*)

Northern Indian Ocean (*Sinobatis andamanensis*)

Eastern Indian Ocean (*Sinobatis bulbicauda* and *S. caerulea*)

North-West Pacific (*Sinobatis borneensis*, *S. melanosoma* and *S. stenosoma*)

South-West Pacific (*Sinobatis filicauda*)

Anacanthobatis (1 species, p. 496)

Indobatis (1 species, p. 497)

Schroederobatis (1 species, p. 498)

Sinobatis (8 species, pp. 499–506)

Springeria (2 species, pp. 507–508)

SPOTTED LEGSKATE

22.1

Anacanthobatis marmorata (von Bonde & Swart, 1923)

DD

IDENTIFICATION. Very small legskate with an extremely depressed, pear-shaped (in females and juvenile males) to broadly heart-shaped (in adult males) disc, dorsal surface mottled, and snout long and narrowly pointed with short, thin filament at its tip. Disc anterior margin almost straight to slightly convex, anteriormost pectoral radials almost reaching snout tip. Ventral head length 26–29% of TL; preoral length 14–19% of TL. Snout length 3.6–4.2 times interorbital distance, 4.6–5.1 times in disc width. Eyes moderately large to large, orbit 2.5–4.4 times in snout length; eyes positioned close to spiracles. Mouth small with 28–35 tooth rows in each jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender and cord-like, usually slightly longer than disc length; caudal fin small and narrow. Pectoral fin with 72–79 radials. Claspers short (postcloacal length ~18% of TL) and thick in adult male, without a sharply serrated cartilage.

COLOUR. Dorsal surface irregularly mottled light brown and white, with randomly scattered light brown ocelli with pale outer margins; papillae and rostral filament dark brown. Ventral surface uniformly pale.

SIZE. Attains at least 29 cm TL. Males and females are mature at ~23 cm TL. Size at hatching unknown.

HABITAT AND BIOLOGY. South-West Indian Ocean; South Africa to Mozambique. Deepwater, on soft bottoms near continental shelf break and on upper slope at 200–435 m depths. Probably a bottom-dweller, feeding mainly on benthic invertebrates and small fishes. Legskates have been filmed swimming well above the bottom in midwater off Africa.

SIMILAR SPECIES. No other legskates are known to have a similar mottling pattern on the upper surface. The structure of cartilages that form the clasper is also unlike any other member of the group.

BLACK LEGSKATE

22.2

Indobatis ori (Wallace, 1967)

DD

IDENTIFICATION. Small legskate with an extremely depressed pear-shaped (in females and juvenile males) to broadly heart-shaped (in adult male) disc, and snout long and narrowly pointed with short, thin filament at its tip in juveniles. Disc anterior margins almost straight to slightly convex, anteriormost pectoral radials almost reaching snout tip. Ventral head length 23–27% (in juveniles) to 31–32% (in adults) of TL; preoral length 15–19% (in juveniles) to 21–24% (in adults) of TL. Snout length 3.9–6.9 times interorbital distance, 2.3–3.4 times in disc width. Eyes small, orbit 5–8 times in snout length in juveniles, but ~9–10 times in snout length in adults; eyes close to spiracles. Mouth small with 16–26 tooth rows in each jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender and cord-like, its length about equal to disc length in adults, but 1.5–1.8 times disc length in juveniles; caudal fin small and narrow. Pectoral fin with 67–73 radials. Claspers short (postcloacal length ~16% of TL) and slender in adult male, with a sharply serrated cartilage.

COLOUR. Dorsal surface dark greyish brown, somewhat paler than ventral surface; interspiracular pores indistinct; posterior and outer parts of ventral surface somewhat darker than anterior part and along mid-body.

SIZE. Attains at least 43 cm TL. Maturity and hatching sizes unknown.

HABITAT AND BIOLOGY. South-West Indian Ocean; off Mozambique and Madagascar. Very deep water, over soft bottoms on mid to outer continental slope at 1000–1725 m depths. Probably feeds on bottom-dwelling invertebrates and small fishes.

SIMILAR SPECIES. No other similar legskates known in the same general region. The Spotted Legskate (22.1) has a shorter tail and the dorsal surface of the disc is mottled (rather than plain coloured).

AMERICAN LEGSKATE

22.3

Schroederobatis americana (Bigelow & Schroeder, 1962)

DD

IDENTIFICATION. Small legskate with an extremely depressed, pear-shaped (in females and juvenile males) to broadly heart-shaped (in adult male) disc, and snout very long, narrowly pointed and ending in short, thin filament. Disc anterior margins almost straight to slightly convex, anteriormost pectoral radials almost reaching snout tip. Ventral head length ~28–29% of TL; preoral length 19–22% of TL. Snout length 6.4–7.9 times interorbital distance, 3–3.4 times in disc width. Eyes moderately large, orbit 3.9–4.8 times in snout length; eyes close to spiracles. Mouth small with 20–26 tooth rows in each jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender and cord-like, slightly longer than disc length; caudal fin small and narrow. Pectoral fin with 63–66 radials. Claspers short (postcloacal length ~17% of TL) and slender in adult male, without a shield and sharply serrated cartilage.

COLOUR. Dorsal surface largely plain greyish to brownish, terminal filament slightly darker. Ventral surface pale greyish or white anterior to nostrils and around mouth; dark brown mottling between mouth and central disc; rest of disc and pelvic fins dark brown except for broken white and brown markings along anterior pelvic-fin lobes; cloacal opening with white edge; tail brown except for conspicuous white tip and some darker mottling.

SIZE. Attains at least 38 cm TL. Males mature at ~30–32 cm TL. Size at hatching ~9 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; Belize to Suriname. Soft bottoms near continental shelf break and on upper slope at 185–915 m depths. Probably a bottom-dweller, feeding on benthic invertebrates and small fishes.

SIMILAR SPECIES. Differs from the Longnose Legskate (22.13), also from the Western Central Atlantic, in dorsal coloration (greyish or brownish rather than purplish), and a smaller maximum size and shorter snout.

ANDAMAN LEGSKATE

22.4

Sinobatis andamanensis Last & Bussarawit, 2016

NE

IDENTIFICATION. Small legskate with a weak, heart-shaped disc, very long and proboscis-like snout ending in minute fleshy filament, moderately elongate tail, and dark coloration above and paler ventrally. Disc anterior margins deeply concave forward of eyes in both sexes; anteriormost pectoral radials ending well short of snout tip; ventral head length 36–41% of TL; preoral length 24–32% TL, ratios much larger in adult females. Snout length 7–9.5 times interorbital distance, 1.8–2.5 times in disc width. Eyes medium-sized, snout length 6.6–7.9 times orbit length in males, up to 11 times in females; spiracle large and close to orbit. Mouth small with 25–29 tooth rows. Skin smooth, except for small alar thorn patches in adult male. Tail very slender; not bulbous near its tip; caudal fin small, upper lobe longer than lower lobe. Pectoral fin with 69–73 radials. Claspers short (postcloacal length ~12–15% of TL) and stout in adult males.

COLOUR. Dorsal surface brownish to greyish pink (sometimes bluish); whitish along anterior disc margin, hind margin dark brown or blackish; outer posterior lobe of pelvic fin and alar region dark brown; clasper and anterior lobe of pelvic fin white. Undersurface uniformly whitish to translucent.

SIZE. Attains at least 34 cm TL. Males mature from ~33 cm TL; hatching size unknown.

HABITAT AND BIOLOGY. Northern Indian Ocean; known from off Myanmar, but probably more widely distributed in Bay of Bengal. Little known, probably benthic on soft bottoms of continental slope.

SIMILAR SPECIES. Resembles the West Australian Legskate (22.7) in body shape, but has a relatively longer snout (length 7–9.5 *vs.* 4–6.6 times interorbital distance), and lacks a bulbous expansion on the posterior part of the tail.

BORNEO LEGSKATE 22.5

Sinobatis borneensis (Chan, 1965)

LC

IDENTIFICATION. Small legskate with a pronounced heart-shaped disc, snout long and narrowly pointed, short and thin filament at snout tip, anterior margins of disc with conspicuous concavities at levels of snout and eyes, and anteriormost pectoral radials almost reaching snout tip. Disc more strongly heart-shaped in adult males than females and juveniles; ventral head length ~38% of TL; preoral length ~25% TL. Snout length ~6.5 times interorbital distance, ~2.9 times in disc width. Eyes small, orbit ~6.3 times in snout length and remote from its tip; close to spiracles. Mouth small with 25–26 tooth rows. Skin smooth, except for small alar thorn patches in adult male. Tail short and very slender; not bulbous near its tip; caudal fin small and narrow. Pectoral fin with 70–76 radials. Claspers long and slender in adult males.

COLOUR. Dorsal surface whitish to pale greyish, often paler than the ventral surface; interspiracular pores indistinct; posterior part of ventral surface brownish and darker than anterior part.

SIZE. Attains 35 cm TL. Males mature at ~25 cm TL; hatching size unknown.

HABITAT AND BIOLOGY. North-West Pacific; Malaysian Borneo to northern China, including Philippines and Taiwan. Soft bottoms of upper continental slope at 315–990 m depths. Feeds on benthic invertebrates and small fishes. A rather large teleost has been found in the stomach of the adult male holotype.

SIMILAR SPECIES. Has been confused with the Blackbody Legskate (22.10), which occurs in the same general region. However, the Blackbody Legskate has dark brown dorsal and ventral disc surfaces (*vs.* typically pale), and reaches a larger maximum size (~60 cm TL).

SHORTTAIL LEGSKATE

22.6

Sinobatis brevicauda Weigmann & Stehmann, 2016

NE

IDENTIFICATION. Medium-sized legskate with an extremely depressed and very broad, pear-shaped disc, snout very long and narrowly pointed, and short, thin filament at snout tip. Disc anterior margins slightly convex, anterior-most pectoral radials almost reaching snout tip. Ventral head length ~41% of TL; preoral length ~30% of TL. Snout length ~6.6–6.7 times interorbital distance, ~2.5–2.6 times in disc width. Eyes small, orbit ~7.9–8.1 times in snout length; eyes close to spiracles. Mouth small with 25–27 tooth rows in each jaw. Skin smooth, probably apart from small alar thorn patches in adult male. Tail very short and slender, slightly depressed anteriorly, its length less than half of disc length and ~35–36% of TL; caudal fin rudimentary. Pectoral fin with 71–72 radials.

COLOUR. Dorsal surface pale greyish brown, ventral surface anteriorly white to level of lower jaw and between gills, posterior part of disc and underside of tail pale greyish brown with blotches at transition from white to brown; underside of posterior pelvic lobe medium greyish brown, anterior lobes dark brown with an indistinct white blotch near the tip and a distinct white blotch at origin; interspiracular pores indistinct.

SIZE. Attains at least 59 cm TL. Known from only 2 female specimens.

HABITAT AND BIOLOGY. Central Indian Ocean; Saya de Malha Bank, likely to be more widespread. Deep insular slopes at 960–1130 m depths. Probably feeds on benthic invertebrates and small fishes. A rather large teleost was found in the stomach of the female paratype.

SIMILAR SPECIES. No similar legskates are known from the same geographic region. Resembles the West Australian Legskate (22.7), a relative from the Eastern Indian Ocean, but has a longer snout and head, and a shorter and less bulbous tail.

WEST AUSTRALIAN LEGSKATE

22.7

Sinobatis bulbicauda Last & Séret, 2008

LC

IDENTIFICATION. Medium-sized legskate with an enlarged, pearl-shaped to heart-shaped disc, snout long and ending in short triangular lobe, tail short with flattened lobe near its tip and ending in thin filament, and caudal fin minute and barely detectable. Disc strongly heart-shaped with concave anterior margins in adult males, more pear-shaped in females and juveniles with straight margins; anteriormost pectoral radials almost reaching snout tip. Ventral head length 23–36% of TL, preoral length 16–28% TL, ratios higher in adults than young. Snout narrowest in adult males, length 4–6.6 times interorbital distance. Eyes medium-sized, orbit 4.7–8.8 times in snout length; spiracles very small, positioned well behind eyes. Mouth small with 21–26 tooth rows in upper jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender anteriorly, broadened near its tip; caudal fin rudimentary. Pectoral fin with 66–71 radials. Claspers long (postcloacal length ~17–21% of TL) and slender in adult males.

COLOUR. Dorsal surface pale brown to greyish brown, paler yellowish on snout beside rostral cartilage; eyes dark. Undersurface translucent white.

SIZE. Attains 56 cm TL. Males mature at ~43 cm TL; smallest neonatal juvenile 13 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; Australia (Shark Bay) to eastern Indonesia. Outer continental shelf and upper slope in depths of 150–1125 m. Life history unknown, probably feeds on small fishes and invertebrates.

SIMILAR SPECIES. Occurs in the same general region as the larger Indigo Legskate (22.8), but usually occurs on shallower parts of the continental slope off Western Australia. The West Australian Legskate differs from its relative in colour (largely brownish rather than bluish) and has a distinctive bulb-like process near the tail tip (otherwise missing).

INDIGO LEGSKATE

22.8

Sinobatis caerulea Last & Séret, 2008

DD

IDENTIFICATION. Medium-sized bluish legskate with a greatly enlarged, heart-shaped disc, snout very long and ending in prominent narrow triangular lobe, tail very short and lacking flattened lobe near its tip, and caudal fin minute and barely detectable. Disc with double concave anterior margins; anteriormost pectoral radials just short of snout tip. Ventral head length 38–42% of TL, preoral length 28–32% TL, ratios higher in females than males. Snout length 5.7–6.7 times interorbital distance. Eyes small, partly concealed beneath skin, orbit 11–16 times in snout length; spiracles very small, positioned well behind eyes. Mouth small with 24–29 tooth rows in upper jaw. Skin smooth, except possibly for small alar thorn patches in adult male. Tail very slender throughout; caudal fin rudimentary. Pectoral fin with 72–76 radials. Clasper shape of adult males unknown.

COLOUR. Dorsal surface bluish to dark bluish grey, not obviously paler on snout beside rostral cartilage; rostral lobe noticeably paler than snout, with a black tip; eyes dark. Undersurface bluish, similar to upper surface; rostral lobe, area around mouth, and tail white.

SIZE. Attains at least 68 cm TL. Male specimen still immature at 54 cm TL; hatching size unknown.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia, also unconfirmed reports off Indonesia. Upper continental slope at depths of 480–1170 m. Uncommon and life history unknown, but probably feeds on invertebrates and bony fishes.

SIMILAR SPECIES. One of the largest legskates, it differs from the West Australian Legskate (22.7), in having a bluish coloration on both surfaces (rather than being brownish on the dorsal surface and white below). The smaller Andaman Legskate (22.4) may also have a bluish grey dorsal surface but its undersurface is whitish (rather than bluish).

EAST AUSTRALIAN LEGSKATE

22.9

Sinobatis filicauda Last & Séret, 2008

DD

IDENTIFICATION. Medium-sized legskate with an enlarged, pear-shaped to heart-shaped disc, snout moderately elongate ending in very short triangular lobe, tail short and lacking flattened lobe near its tip, and caudal fin minute and barely detectable. Disc strongly heart-shaped with deep concave anterior margins in adult males, broadly pear-shaped in females and juveniles with straight to weakly concave margins; anteriormost pectoral radials almost reaching snout tip. Ventral head length 32–34% of TL, preoral length 23–26% TL, ratios for adults and young similar. Snout narrower in adult males than females, length 4.1–5.1 times interorbital distance. Eyes medium-sized, orbit 7.1–9.6 times in snout length; spiracles very small, positioned well behind eyes. Mouth small with 18–22 tooth rows in upper jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender over its entire length, not thickened; caudal fin rudimentary. Pectoral fin with 71–75 radials. Claspers rather long (postcloacal length ~18% of TL) and moderately robust in adult males.

COLOUR. Dorsal surface pale brownish, darker bluish grey over gills and abdomen; alar patches demarcated by dark blotches; eyes bluish black. Undersurface translucent to bluish white, some dark areas around posterior half of disc.

SIZE. Attains at least 55 cm TL (an adult male); hatching size unknown.

HABITAT AND BIOLOGY. South-West Pacific; Queensland (Australia), possibly more widespread in Northern Coral Sea. Upper continental slope in 605–880 m depth. Reasonably common but life history unknown.

SIMILAR SPECIES. Resembles the West Australian Legskate (22.7) from the Eastern Indian Ocean in disc shape, but lacks a bulbous process near the tail tip characterising that legskate.

BLACKBODY LEGSKATE

22.10

Sinobatis melanosoma (Chan, 1965)

LC

IDENTIFICATION. Medium-sized legskate with an extremely depressed pear-shaped (in females and juvenile males) to broadly heart-shaped (in adult male) disc, snout long and narrowly pointed, and short and thin filament at snout tip. Disc anterior margins almost straight to slightly convex, anteriormost pectoral radials almost reaching snout tip. Ventral head length ~26–30% of TL; preoral length ~15–21% of TL. Snout length ~2.9–5.2 times interorbital distance, ~2.9–3.7 times in disc width. Eyes small, orbit ~4.2–6.4 times in snout length; eyes close to spiracles. Mouth small with 23–29 tooth rows in each jaw. Skin smooth, except for small alar thorn patches in adult male, and median row of 6 minute thorn-like denticles on tail in small juvenile. Tail very slender and cord-like, slightly shorter than disc length in large specimens, but ~1.8 times disc length in juveniles; caudal fin well developed. Pectoral fin with 69–75 radials. Claspers short (postcloacal length ~18% of TL) and slender in adult male, without a sharply serrated cartilage.

COLOUR. Disc dorsally and ventrally blackish brown with black areas around the spiracles and orbits; area around mouth and anterior pelvic lobes pale; tail brownish dorsally, pale ventrally.

SIZE. Attains ~60 cm TL, at least 38 cm DW. Males mature at ~53 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; Vietnam to southern Japan, including Taiwan, Hong Kong and Philippines. Little known legskate, possibly occurring over soft bottoms of continental slope in 575–1100 m depth.

SIMILAR SPECIES. Differs from the Borneo Legskate (22.5) in reaching a much larger adult size (60 cm TL *vs.* 35 cm TL) and having darker dorsal and ventral surfaces.

NARROW LEGSKATE

22.11

Sinobatis stenosoma (Li & Hu, in Chu, Meng, Hu & Li, 1982)

DD

IDENTIFICATION. Medium-sized legskate with an extremely depressed, pear-shaped disc, snout long, broadly triangular, and small, thin and fleshy filament at snout tip. Disc anterior margins almost straight, anteriormost pectoral radials almost reaching snout tip. Ventral head length ~36% of TL; preoral length ~27% of TL. Snout length ~5.6 times interorbital distance, ~2.3 times in disc width. Eyes small, somewhat oblique, orbit ~7 times in snout length; spiracles very small, positioned well behind eyes. Mouth small with ~22 tooth rows in each jaw. Skin smooth, probably except for small alar thorn patches in adult male. Tail very slender, cord-like, anteriormost part joined to full length of pelvic fins; length from cloaca ~0.6 times disc length; caudal fin small and narrow.

COLOUR. Dark greyish brown dorsally, interspiracular pores indistinct, pale ventrally.

SIZE. Attains at least 52 cm TL. Known from only 1 female specimen.

HABITAT AND BIOLOGY. North-West Pacific; off China (South China Sea). Upper continental slope at ~535 m depth. Life history unknown.

SIMILAR SPECIES. Similar to the Blackbody Legskate (22.10), but the unique type specimen of the Narrow Legskate has a much paler ventral coloration. Nevertheless, it might prove to be conspecific with that species as it seems unusual that no other specimens have appeared since 1982, particularly given the high level of fishing effort in deep parts of the China Seas adjacent to Taiwan.

LEAFNOSE LEGSKATE

22.12

Springeria folirostris Bigelow & Schroeder, 1951

DD

IDENTIFICATION. Large legskate with an extremely depressed and broad, heart-shaped disc, long snout with leaf-like lobe at its tip, and long tail with well-developed caudal fin. Disc anterior margins strongly concave, anteriormost pectoral radials close to snout tip. Ventral head length (to base of filament) ~24–27% of TL; preoral length ~6–7% of TL. Leaf-like lobe on snout with a long slender filament at its tip, lobe width similar to interorbital space. Snout length ~8.4–8.6 times interorbital distance, ~2.6 times in disc width. Eyes small, orbit ~7–9 times in snout length (greater values in adults); spiracles very small, positioned well behind eyes. Mouth very small, arched, with 24–26 tooth rows in upper jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender and cord-like, longer than disc (to base of leaf-like extension), equal to or exceeding disc width; caudal-fin lobes both well developed, separated at tail tip by vertebral column. Claspers short and slender in adult male, without a sharply serrated cartilage.

COLOUR. Dorsal surface greyish brown, markedly translucent on snout beside rostral cartilage; often with whitish areas where skin has been abraded; expansion on snout often black-edged. Undersurface pale greyish.

SIZE. Females attain 62 cm TL (to base of filament), males smaller to 58 cm TL; hatching size unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; southern USA (Gulf of Mexico). Occurs over soft bottoms on upper continental slope at 300–510 m depths. Life history unknown.

SIMILAR SPECIES. Occurs in Gulf of Mexico with the Longnose Legskate (22.13), and usually at shallower depths. It has a characteristic leaf-shaped extension at the tip of the snout and better-developed lobes on the caudal fin than the Longnose Legskate.

LONGNOSE LEGSKATE

22.13

Springeria longirostris (Bigelow & Schroeder, 1962)

DD

IDENTIFICATION. Very large legskate with a strongly depressed, pear-shaped (in females and juveniles) to broadly heart-shaped (in adult males) disc, snout very long and narrowly pointed, and short and thin filament at snout tip. Disc anterior margins almost straight to slightly convex, anteriormost pectoral radials almost reaching snout tip. Ventral head length 37–40% of TL; preoral length 29–32% of TL in large specimens, but only 24% of TL in 1 small juvenile. Snout length 7.5–10.4 times interorbital distance (larger in adults), ~1.9–2.4 times in disc width. Eyes very small, orbit ~7–11.8 times in snout length (greater values in adults); eyes close to spiracles. Mouth small with 24–28 tooth rows in each jaw. Skin smooth, except for small alar thorn patches in adult male. Tail very slender and cord-like, shorter than disc length in adults, but slightly longer than disc length in small juveniles; caudal fin with well-developed upper and very narrow lower lobe. Pectoral fin with 92–96 radials. Claspers short and slender in adult male, without a sharply serrated cartilage.

COLOUR. Dorsal surface light purplish to purplish grey; terminal filament black. Undersurface lighter blue; anterior part of snout dusky.

SIZE. Attains at least 75 cm TL. Maturity and hatching sizes unknown.

HABITAT AND BIOLOGY. Western Central Atlantic; southern USA (Gulf of Mexico) and Caribbean. Deepwater demersal, occurs over soft bottoms on continental slope at depths of 500–1050 m. Probably feeds on benthic invertebrates and small fishes. A relatively large teleost and a claw of a crab have been found in one female.

SIMILAR SPECIES. Larger, more delicate, and having a relatively longer snout than the American Legskate (22.3). Overlaps in distribution with the Leafnose Legskate (22.12) but lacks a leaf-like lobe at the snout tip characterising that species.

23

SIXGILL STINGRAYS

Family Hexatrygonidae

B. Séret & M.R. de Carvalho

Sixgill stingrays are large rays (reaching ~1.7 m TL) with a heavy, flabby, heart-shaped disc with broadly rounded and rather short pelvic fins. The snout is long, broad based and triangular in adults, and its shape and length vary with growth and preservation. The tail is short with 1 or 2 caudal stings and a low, elongate caudal fin with noticeable dorsal and ventral lobes. Six pairs of small gill slits are located on the ventral head. Eyes are small and positioned well forward of very large spiracles. Its mouth is large, wide, tube-like and highly protractile. Nostrils are well separated with nasal flaps fused to form a short, broad nasal curtain that does not overlap the mouth. The entire body is smooth, devoid of denticles, and the skin is very thin and easily damaged. Viviparous (histotrophic). Several species of sixgill stingrays have been described from the South China Sea, based mainly on relative snout length and shape. At present, pending further morphological and genetic analyses, they are considered as either ontogenetic or intraspecific variations of a single, widely distributed species, *Hexatrygon bickelli*. A rarely caught ray with few specimens recorded and preserved. Probably widespread in deep parts of the tropical Indo–Pacific, but its known distribution is patchy. Appears to be most common off Taiwan but this may be an artefact of fishing effort.

SIXGILL STINGRAY

23.1

Hexatrygon bickelli Heemstra & Smith, 1980

LC

IDENTIFICATION. Large stingray with a soft, extremely flabby heart-shaped disc with a long triangular snout, small widely separated eyes, and short tail with long and slender caudal fin. Disc deeply concave beside eyes, apex broadly rounded, posterior margin evenly convex. Snout highly flexible and gelatinous, pointed, broad based and triangular; its shape and length varying with growth, much shorter and more obtuse in juveniles than adults. Eyes positioned far apart, closer to disc edge than to each other; separated from very large, obliquely oriented spiracles by several times corneal length. Six widely separated pairs of small gill slits. Mouth very broad, straight, capable of projecting forward to form a narrow tube. Nostrils widely set apart, nasal curtain broad but extremely short. Skin smooth on both sides, without denticles; very delicate and easily rubbed off or torn. Pelvic fins very small, narrower than mouth width across their bases. Tail much shorter than disc, slender but not whip-like, with one or two stings; caudal fin well developed, elongate, with upper and lobes narrow and similar in length.

COLOUR. Dorsal side of disc pale pinkish to reddish brown with slightly darker posterior margins; snout whitish to somewhat translucent; tail brownish with brownish black caudal fin. Ventral side largely milky white; pectoral and pelvic fins with broad dusky to black margins.

SIZE. Attains 170 cm TL. Males mature at ~110 cm TL, females at ~113 cm TL; born at ~45–48 cm TL.

HABITAT AND BIOLOGY. Indo–Pacific; South Africa to Hawaii (USA). Deepwater demersal, occurring on both soft and rocky bottoms, mainly on continental and insular slopes at 360–1120 m depths, rarely found in shallow water near the coast. Produces litters of 2–3 pups. Feeds on benthic invertebrates, mainly shrimps, which are presumably ingested using its tube-like protractile mouth. The highly dexterous snout is presumably used as a sensory organ to detect prey items in the substrate.

SIMILAR SPECIES. All other ray species possessing a caudal sting have 5 (rather than 6) pairs of gill slits.

24

BUTTERFLY RAYS

Family Gymnuridae

L. Yokota, W.T. White & M.R. de Carvalho

Butterfly rays are medium-sized to large rays (adults less than 1 m DW to at least 2.6 m DW). They are distinguished from other batoids by a distinct lozenge-shaped disc (at least 1.5 times broader than long), and short, slender whip-like tail. The snout is short and obtuse, without a rostral cartilage, and the head is not raised above the strongly depressed, flat disc. Sexual dimorphism is evident in some species, with adult males presenting a more angular disc, and acute and longer snouts. Eyes are dorsolateral and small, followed by rather large spiracles that may have a small tentacle on the inner posterior margin. Mouth is wide, arched and without papillae on floor. Jaws are very slender, bearing numerous, uniform small teeth in bands. Tail is slender and short, usually cross-banded; dorsal and ventral skin folds may be present. A small dorsal fin at tail base and serrated caudal stings are variously present. Skin is usually entirely smooth. Colour patterns are variable and may be associated to substrate. Butterfly ray species are similar to each other morphologically and exhibit intraspecific variation; taxonomic uncertainties involving their identification are common. Identification relies on a combination of characters, such as presence/absence of spiracular tentacles, dorsal fin and caudal sting(s), and relative size of the tail, as well as the number of black bands on tail. Ten named species are recognised in a single genus, *Gymnura* (*Aetoplatea* is a synonym); the group is being revised and new species will be described soon. Marine, coastal and demersal, usually occurring on soft bottoms. Viviparous (lipid histotrophy), produces 1–16 pups; some tropical species may reproduce throughout the year. Primarily eats fishes, but they also consume invertebrates. Caught mainly as bycatch in various tropical fisheries, generally of low commercial value, with the flesh used as fishmeal in some areas.

SPINY BUTTERFLY RAY

24.1

Gymnura altavela (Linnaeus, 1758)

VU

IDENTIFICATION. Very large butterfly ray with a small tentacle on inner posterior margin of spiracle, short tail (post-cloacal length 18–23% DW) with 3–5 black bands (usually not well demarcated), 1 or more caudal stings, and dorsal fin absent or tiny and vestigial. Disc much broader than long (1.8–2.2 times). Snout short, preoral length 8–10% DW. No sexual dimorphism in disc shape. Eyes very small (orbital length 11–24% interorbital width). Spiracle with concave inner margin but with a subtle convex undulation anterior to tentacle; spiracular tentacles slender, length 1–2.1% DW. Mouth arched, lower jaw with concave symphysis due to mid-lateral projections (sometimes forming hard protuberances). Skin usually entirely smooth, but large individuals may have a few denticles on upper surface. Caudal stings strong and well developed. Tail usually longest in embryos and small juveniles (post-cloacal length 24–30% DW).

COLOUR. Dorsal surface light to dark brown, greyish or blackish; variously marked with small dark dots or irregular dark or pale spots or blotches, often in a marbled pattern (sometimes vermiculate); distinct white blotch rarely present near 1 or both spiracles. Ventral surface white to brownish. Tail banding not well demarcated, often diffuse.

SIZE. Attains at least 260 cm DW, maximum recorded weight 290 kg. Males mature at 78–130 cm DW, females at 102–108 cm DW; birth size 38–44 cm DW.

HABITAT AND BIOLOGY. Atlantic Ocean and Mediterranean Sea; discontinuous off Americas. Benthic, in shallow coastal waters over sand and mud generally to depths of 150 m; distribution probably habitat dependent. 1–8 pups produced annually after a 4–9 month gestation. Feeds on crustaceans, molluscs and fishes (which sometimes includes other rays).

SIMILAR SPECIES. Resembles the Backwater (24.7) and Australian (24.2) Butterfly Rays; former has a smaller spiracular tentacle (0.1–0.6% DW), and latter is a much smaller species with 1–7 bands on tail, usually a larger dorsal fin (when present), and usually without caudal stings. Population off tropical Africa thought to be a similar undescribed species (currently under investigation). *Gymnura hirundo* (Lowe) is probably a junior synonym.

AUSTRALIAN BUTTERFLY RAY

24.2

Gymnura australis (Ramsay & Ogilby, 1886)

LC

IDENTIFICATION. Small butterfly ray possessing a small tentacle on the inner posterior margin of spiracle, short tail (post-cloacal length 16–29% DW) with 1–7 blackish bands, small dorsal fin on tail base present or absent, and caudal stings mostly absent. Disc much broader than long (1.8–2 times). Snout short, preoral length 8–10% DW. Sexual dimorphism in disc shape not evident. Eyes small (orbital length 16–30% interorbital width). Spiracular tentacle slender (eastern form) to more rounded and thickened (northern form). Mouth arched, lower jaw with concave symphysis due to mid-lateral projections (sometimes forming hard protuberances). Skin entirely smooth. Often with a single, poorly developed caudal sting.

COLOUR. Dorsal surface greenish, greyish or light to dark brown; often with a peppering of black spots varying in density and intensity, over a delicate mosaic pattern; an irregular blotch often present near each pectoral-fin insertion; some specimens with a few large, irregular whitish blotches. Ventral surface whitish to copper, sometimes with margins darkened. Individuals from eastern Australia sometimes with extremity of tail uniformly black due to merging of bands posteriorly.

SIZE. Attains at least 94 cm DW and 7.4 kg. Males mature at 35–42 cm DW, females 44–46 cm DW; born at 22–25 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; northern Australia and New Guinea. Benthic, coastal to offshore on continental shelf in relatively open sandy, muddy and silty environments, including estuaries and intertidal zones, to a depth of at least 250 m. Produces litters of 1–6 pups. Primarily a specialist feeder on bony fishes; frequently ingests very large fishes for its size.

SIMILAR SPECIES. Two distinct variants of this species exist: an eastern Australian form with a shorter tail (post-cloacal length 16–25% DW) with 1–3 bands, and sometimes with a dorsal fin; and a northern Australian form, having a longer tail (post-cloacal length 22–29% DW) with 4–7 bands, and always with a dorsal fin. Most similar to the Spiny Butterfly Ray (24.1), which is a significantly larger species with 3–5 black tail bands that are usually not clearly demarcated, dorsal fin absent (or tiny and vestigial), and always with caudal stings.

MAZATLAN BUTTERFLY RAY

24.3

Gymnura crebripunctata (Peters, 1869)

DD

IDENTIFICATION. Small butterfly ray lacking a tentacle on inner posterior margin of spiracle, very short tail (post-cloacal length 16–22% DW) without caudal stings or dorsal fin, bands on tail diffuse and faint. Disc much broader than long (1.6–1.9 times). Snout short, preoral length 8–14% DW. Sexual dimorphism evident, juveniles and females with a rounded disc and obtuse snout; adult males with a more angular disc and longer, more acute snout. Eyes very small (orbital length 12–24% interorbital width). Spiracle with strongly concave inner margins. Mouth arched, lower contour usually convex. Skin entirely smooth.

COLOUR. Dorsal surface often fully covered with irregular circular spots flanked by smaller black spots, sometimes resembling leopard spots; may be uniformly pale to dark brown, vermiculate, or with a few pale or dark spots, and pale stripes on disc edges. Ventral surface whitish to copper.

SIZE. Attains at least 81 cm DW; males mature at ~30 cm DW; size at maturity of females and at birth unknown.

HABITAT AND BIOLOGY. Eastern Pacific; southern California (USA) to northern Peru. Benthic, inshore, on sandy and muddy substrates of coasts and estuaries to at least 30 m depth. No life history information available, but diet appears to consist primarily of teleost fishes. May utilise inshore habitats for breeding and nursery functions.

SIMILAR SPECIES. Californian Butterfly Ray (24.5) has a tail with a slightly diphycercal tip with caudal stings; Smooth Butterfly Ray (24.6) has a weaker dorsal fold on tail and more pronounced tail banding. *Gymnura afuerae* (Hildebrand) is a junior synonym.

JAPANESE BUTTERFLY RAY

24.4

Gymnura japonica (Temminck & Schlegel, 1850)

DD

IDENTIFICATION. Large butterfly ray lacking a tentacle on inner posterior margin of spiracle, short tail (post-cloacal length 20–28% DW) with 5–9 black bands, lacking a small dorsal fin at tail base, and caudal stings always present. Disc much broader than long (1.8–2.2 times). Snout short, preoral length 2–3.3 in post-cloacal length. Sexual dimorphism in disc shape less evident than in some other *Gymnura* species, but adult males tend to have a relatively longer snout than females. Eyes very small (orbital length 9–24% interorbital width). Spiracle with curved and concave inner margins. Mouth arched, lower jaw with concave symphysis due to mid-lateral projections (sometimes forming hard protuberances). Skin entirely smooth. Caudal sting usually poorly developed. Tail length 45–60% of snout–cloaca length. Embryos and small juveniles usually have longer tails than adults (post-cloacal length 27–34% DW).

COLOUR. Dorsal surface uniform brown, black or grey, sometimes with some irregular dark spots; a large white spot occasionally present behind (or lateral to) each or just 1 spiracle. Ventral surface whitish to brownish or copper, often with darker disc margins. Tail bands sometimes diffuse with tail becoming black (mainly in large specimens); occasionally a single dark spot present between each black band.

SIZE. Attains at least 145 cm DW. Males mature at 40–50 cm DW; born at ~18 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Japan to southern China. Benthic inshore on sandy and muddy bottoms. Produces litters of 2–8 pups. Diet poorly documented, possibly based on bony fishes like other members of family.

SIMILAR SPECIES. Most similar to the Zonetail Butterfly Ray (24.10), which has a longer tail (post-cloacal length 52–80% of snout–vent length, 6–10 black bands) often with a small dorsal fin on its base, and preoral length 2.8–4.5 times post-cloacal length. *Gymnura bimaculata* (Norman) is a junior synonym.

CALIFORNIAN BUTTERFLY RAY

24.5

Gymnura marmorata (Cooper, 1864)

LC

IDENTIFICATION. Medium-sized butterfly ray lacking a tentacle on inner posterior margin of spiracle, very short tail (post-cloacal length 14–23% DW) without bands, one or more serrated caudal stings present on tail, but dorsal fin absent. Disc much broader than long (1.6–1.9 times). Snout short, preoral length 9–15% DW. Sexual dimorphism evident, juveniles and females with rounded disc and obtuse snout; adult males with a more angular disc and longer, more acute snout. Eyes very small (orbital length 10–27% interorbital width). Spiracle with concave inner margin. Mouth arched, lower-jaw symphysis straight to slightly concave. Skin entirely smooth. Caudal stings thinner and proportionally smaller in juveniles, eventually covered by a fleshy layer. Tail somewhat diphycercal at tip.

COLOUR. Dorsal surface light to dark brown, greyish or blackish; occasionally marked with a few discrete and irregular, pale or dark spots (sometimes vermiculate). Ventral surface white to brownish with brown-grey shading along outer disc margins, more prominent posteriorly.

SIZE. Attains at least 125 cm DW (possibly to 150 cm DW). Males mature at 41 cm DW, females 62 cm DW; born between 21–26 cm DW.

HABITAT AND BIOLOGY. Eastern Pacific; southern California (USA) to Mexico, including Gulf of California. Benthic, inshore in sandy bays, beaches, silty or muddy channels, and estuaries, to a depth of 95 m. Pregnant females move inshore in aggregations to pup; newborns use shallow waters as nursery grounds. Produces litters of 4–16 pups, mainly in May to September, although the births can occur throughout the year. Diet consists almost exclusively of teleost fishes.

SIMILAR SPECIES. Most similar to the Mazatlan Butterfly Ray (24.3), which has a tail without a diphycercal tip and lacking caudal stings.

SMOOTH BUTTERFLY RAY

24.6

Gymnura micrura (Bloch & Schneider, 1801)

DD

IDENTIFICATION. Medium-sized butterfly ray lacking a tentacle on inner posterior margin of spiracle, short tail (post-cloacal length 16–28% DW) with 3–5 black bands, usually lacking a small dorsal fin at tail base, and no caudal stings. Disc much broader than long (1.5–2 times). Snout short, preoral length 8–16% DW. Sexual dimorphism evident, juveniles and females with rounded disc and obtuse snout; adult males with more angular disc and a longer, more acute snout. Eyes very small (orbital length 13–26% interorbital width). Spiracle with concave inner margin. Mouth arched, lower contour usually convex. Skin entirely smooth. Some males with a small dorsal fin at tail base, its size variably developed.

COLOUR. Dorsal surface light to dark brown or greyish; sometimes with vermiculate patterns or speckled with lighter and darker shades or faint dark round patches; some specimens with light stripes on disc edges. Ventral surface whitish to dusky, darkening toward edges, yellowish in some large individuals; tail normally prominently banded, bands less distinct in some very large adults.

SIZE. In North-West Atlantic, to ~110 cm DW; males mature at ~35 cm DW, females ~55 cm DW, birth size 15–26 cm DW. Smaller in South-West Atlantic, <80 cm DW; males mature at ~27 cm DW, females ~40 cm DW, birth size 14–18 cm DW.

HABITAT AND BIOLOGY. Western Atlantic (northern USA to Brazil) and possibly Eastern Atlantic (Senegal to Angola). Benthic, coastal and primarily on sandy and muddy bottoms, to depths of at least 40 m. Produces litters (1–8 pups) continuously throughout year in tropical regions. Diet consists mainly of bony fishes with evidence of feeding specialisation; may ingest proportionally very large fishes.

SIMILAR SPECIES. Most similar to the Mazatlan Butterfly Ray (24.3), which has a higher dorsal fold on tail and less obvious tail banding. The Eastern Atlantic population is under investigation and may be a separate undescribed species.

BACKWATER BUTTERFLY RAY

24.7

Gymnura natalensis (Gilchrist & Thompson, 1911)

DD

IDENTIFICATION. Very large butterfly ray with a rudimentary tentacle on inner posterior margin of spiracle, very short tail (post-cloacal length 18–24% DW) with 3–5 black bands (usually poorly demarcated), one or more caudal stings, and lacking a dorsal fin. Disc much broader than long (1.8–2.2 times). Snout short, preoral length 8–10% DW. No sexual dimorphism in disc shape. Eyes very small (orbital length 11–21% interorbital width). Spiracle inner margin concave with a subtle convex undulation before tentacle; spiracular tentacle length 0.1–0.7% DW. Mouth arched, lower jaw with concave symphysis due to mid-lateral projections (sometimes forming hard protuberances). Skin usually entirely smooth, but large individuals with some denticles on upper surface. Caudal stings strong and well developed. Tail relatively longer in embryos and small juveniles (post-cloacal length 25–29% DW).

COLOUR. Dorsal surface brown or greyish; disc sometimes with small dark dots or irregular pale spots or blotches, often in a marbled pattern. Ventral surface white to brownish. Tail banding not well demarcated, often diffuse (mainly in large individuals).

SIZE. Attains ~250 cm DW (~120 kg). Males mature at ~95 cm DW, females at ~145 cm DW; birth size 38–47 cm DW.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; Namibia to southern Mozambique. Coastal, benthic on sandy beaches, estuaries, lagoons, and offshore banks, to a depth of 75 m. Produces litters of 2–9 pups after a 1 year gestation; reaches maturity at about 2 years of age in males, 6 years in females. Diet consists of fishes, crabs, polychaete worms, and squids.

SIMILAR SPECIES. Very similar to the Spiny Butterfly Ray (24.1), which has longer spiracular tentacles (1–2.1% DW). These forms are possibly synonyms, but the Backwater Butterfly Ray is maintained as valid pending results of research in progress.

LONGTAIL BUTTERFLY RAY

24.8

Gymnura poecilura (Shaw, 1804)

NT

IDENTIFICATION. Medium-sized butterfly ray lacking a tentacle on inner posterior margin of spiracle, very long tail (post-cloacal length up to 54% DW) with 8–14 black bands, lacking a small dorsal fin at tail base, and caudal stings variously absent or present. Disc much broader than long (1.7–2.1 times). Snout short, preoral length 3.2–6.7 times post-cloacal length. Sexual dimorphism in disc shape not evident. Eyes very small (orbital length 11–21% interorbital width). Spiracle with straight to concave inner margins. Mouth arched, lower-jaw contour may be entirely convex or with a slightly concave symphysis. Skin entirely smooth. Caudal sting seems to emerge during development, so it tends to be absent in juveniles and present in adults (when present, it is small and slender). Characterised by a long tail, but tail size variable (post-cloacal length 31–54% DW); largest individuals tend to have relatively longer tails.

COLOUR. Dorsal surface uniform light to dark brown; sometimes with black dots or with weak round whitish spots. Ventral surface whitish to brownish. Tail banded; dark spot frequently between each black band, sometimes surrounded by 4 smaller black dots (more common in adults); tail banding diffuse, less well defined in very large individuals.

SIZE. Attains at least 104 cm DW, maximum estimated weight 8.3 kg. Males mature at ~35 cm DW, females at ~41 cm DW; birth size 22–26 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; Red Sea to Shanghai (China), including Indonesia and Malaysia. Benthic inshore, primarily on sandy and muddy substrates to a depth of at least 30 m. Produces litters of 1–7 pups; off India, found to breed throughout the year. Diet consists mainly of bony fishes.

SIMILAR SPECIES. Resembles the Zonetail Butterfly Ray (24.10), which has a shorter tail (post-cloacal length 23–36% DW, 6–10 black tail bands) and a small dorsal fin at tail base is frequently present. *Gymnura crooki* is probably a junior synonym of this species.

TENTACLE BUTTERFLY RAY

24.9

Gymnura tentaculata (Müller & Henle, 1841)

DD

IDENTIFICATION. Small butterfly ray possessing a small tentacle on inner posterior margin of spiracle, long tail (post-cloacal length 23–33% DW) and lacking a banding pattern, small dorsal fin at tail base always present, and caudal stings variously absent or present. Disc much broader than long (1.7–2 times). Snout short, preoral length 7–10% DW. Sexual dimorphism in disc shape subtle. Eyes medium-sized, relatively larger than congeners (orbital length 25–38% interorbital width). Spiracular tentacle usually rounded and thick. Mouth arched, lower symphysis slightly concave. Skin entirely smooth. Caudal sting poorly developed when present. Dorsal fin located at tail base, well developed.

COLOUR. Dorsal surface uniform light to dark brown, frequently covered with numerous small whitish spots or dots. Ventral surface whitish to brownish. Tail banding absent.

SIZE. Attains at least 76 cm DW. Males mature at ~40 cm DW; size at maturity of females and size at birth unknown.

HABITAT AND BIOLOGY. Indo–West Pacific; Red Sea to Bay of Bengal. Benthic inshore to a depth of at least 75 m. Little known of its habitat and biology. Diet probably based on teleosts, like other butterfly rays.

SIMILAR SPECIES. Most similar to the Australian Butterfly Ray (24.2), which has a distinctive tail banding pattern (otherwise absent).

ZONETAIL BUTTERFLY RAY

24.10

Gymnura zonura (Bleeker, 1852)

VU

IDENTIFICATION. Medium-sized butterfly ray lacking a tentacle on inner posterior margin of spiracle, long tail (post-cloacal length 23–36% DW) with 6–10 black bands, small dorsal fin at tail base often present (but may be absent), and caudal stings mostly present. Disc much broader than long (1.8–2.1 times). Snout short, preoral length 2.8–4.5 times post-cloacal length. Sexual dimorphism in disc shape less evident than in many other species of family. Eyes small (orbital length 15–30% interorbital width). Spiracle with curved and concave inner margin. Mouth arched, lower symphysis slightly concave. Skin entirely smooth. Caudal sting usually poorly developed, with a large base; tail usually with a groove when sting missing. Tail length 52–80% of snout–cloaca length.

COLOUR. Dorsal surface uniform brown or with numerous small round whitish spots. Ventral surface whitish to brownish. Tail banded, pale sections often with single dark spot between each black band.

SIZE. Attains at least 108 cm DW, maximum weight exceeding 7.3 kg. Males mature at ~48 cm DW, females by 78 cm DW; born 20–21 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; Bay of Bengal (India) to Philippines and Taiwan. Benthic, inshore over soft substrates to a depth of at least 35 m. Produces litters of 2–4 pups. Diet consists primarily of bony fishes and crustaceans.

SIMILAR SPECIES. The Japanese Butterfly Ray (24.4) has a shorter tail (post-cloacal length 45–60% of snout–cloaca length, 5–9 black bands), lacks a dorsal fin, and the preoral length is 2–3.3 times post-cloacal length. The Longtail Butterfly Ray (24.8) has a longer tail (post-cloacal length 31–54% DW, 8–14 black bands) and always lacks a dorsal fin.

25

STINGRAYS

Family Dasyatidae

P.R. Last, B.M. Manjaji-Matsumoto, G.J.P. Naylor & W.T. White

Stingrays are small to massive rays (adults from 23 cm to at least 2.2 m DW), estimated to weigh up to 600 kg, making them amongst the largest of all fishes. They have an almost circular to rhombic disc that is variably depressed and formed by a joining of the head and pectoral-fin skeletons. The head is usually raised slightly and often only weakly demarcated from the rest of the disc. The mouth, which is positioned ventrally forward on the disc, has rows of small teeth in the jaws and often several fleshy papillae on its floor. The tail, which can be greatly extended and even whip-like, is typically longer than the disc and lacks dorsal, anal and caudal fins. Most species have 1 or more serrated caudal stings, and many also have membranous skin folds on the upper and/or lower mid-lines of the tail. Small pelvic fins are located at the base of the tail, and are often fully or partly concealed beneath the disc when viewed from above. The skin varies from being entirely smooth, to covered at varying extents with small denticles, thorns and tubercles; those on the dorsal tail are usually largest. A large ray family, stingrays are represented by at least 86 living species. Recent investigations have confirmed that the 2 largest genera (*Dasyatis* and *Himantura*) each consist of several genera; the family presently contains 19 genera, *Bathytoshia*, *Brevitrygon*, *Dasyatis*, *Fluvitrygon*, *Fontitrygon*, *Hemitrygon*, *Himantura*, *Hypanus*, *Maculabatis*, *Makararaja*, *Megatrygon*, *Neotrygon*, *Pastinachus*, *Pateobatis*, *Pteroplatytrygon*, *Taeniura*, *Taeniurops*, *Telatrygon* and *Urogymnus*. Additional taxonomic changes will be needed as the statuses of some of these species have not been fully resolved. Stingray taxonomy is difficult because of the close similarity in appearance of many species, and due to their large average size they are often poorly represented in museum collections. At least 1 member (i.e. *Pteroplatytrygon*) is free-swimming in the open ocean, but most are demersal inshore on continental and insular shelves (they are rarely found deeper than 400 m). Some stingrays can live in freshwater, occurring in rivers more than 240 km from the coast. They are viviparous with litters of 1–10 pups that can be up to 11 months in gestation. Sometimes targeted by fisheries but usually caught as bycatch from trawls, longlines, beach seines and gill nets. The flesh is used for human consumption (salted and dried in South-East Asia and probably elsewhere) but its acceptance varies regionally. The skin of some species, which is now used to make a variety of leather products (e.g. wallets, bags, shoes), was traditionally used as handle grips for Japanese samurai swords. Large and/or colourful species are important exhibits in aquaria, whereas others are regionally important for ecotourism (e.g. Cayman Islands).

KEY TO DASYATID GENERA

1. No skin folds on tail (fig. 1) (low ventral ridge sometimes present in *Brevitrygon walga* and short fold in *Urogymnus acanthobothrium*); well-developed band of densely packed denticles on disc (fig. 4); base of tail relatively narrow and slightly depressed to almost rounded in cross-section (fig. 6) 2

   Distinct skin fold present on undersurface of tail (low in some species, fig. 2) and sometimes with shorter based fold (fig. 3) or fleshy ridge (fig. 2) on dorsal surface behind sting; band of densely packed denticles absent or not well developed on disc (fig. 5); base of tail relatively broad, slightly to greatly depressed, oval in cross-section (fig. 7) 9

2. Dorsal disc very rough all over, densely covered with long upright thorns (fig. 8); caudal sting absent (fig. 8); Indo–West Pacific and possibly Eastern Atlantic .... ***Urogymnus* (in part, *U. asperrimus*; fig. 8, p. 614)**

   Dorsal disc smooth to granular but not densely covered with long upright thorns; caudal sting usually present, unless damaged (fig. 9) 3

fig. 1

fig. 2

fig. 3

side view of tail near caudal sting

fig. 4

fig. 5

surface of skin

fig. 6

fig. 7

tail base shapes (cross-section)

fig. 8

fig. 9

3. Tail relatively short (usually much <2.2 times DW), with a few well-developed thorns along its mid-line before caudal sting in adults (except in *B. javaensis*), filamentous or slightly bulbous beyond sting (fig. 9); tail base rather broad, depressed (fig. 9); upper surface plain coloured (fig. 9); Indo–West Pacific .... ***Brevitrygon* (4 species; fig. 9, pp. 533–536)**

   Tail whip-like (fig. 10), long to very long in most species (>2.2 times DW, when undamaged); no thorns along its mid-line before caudal sting (except in *Pateobatis jenkinsii* and some *Fluvitrygon*); tail base typically circular to flattened oval in cross-section; upper surface plain coloured or with strong pattern (fig. 10) 4

4. Skin on dorsal disc almost entirely covered with a strong pattern of dark spots (fig. 11), ocelli (fig. 12), or lines and reticulations (sometimes absent in *Fluvitrygon kittipongi* and *F. signifer*) 5

   Skin on dorsal disc plain or partly covered with a pattern of white spots and flecks (fig. 17) (dark spots variably present in *Maculabatis astra* and *M. toshi*) 6

5. Disc elongate oval to almost circular (fig. 10) with broadly rounded pectoral-fin apices; tail not banded (but sometimes marbled in *F. oxyrhinchus*, fig. 10); disc rather thin and with large fleshy lobe at its tip (fig. 10); small rays (<40 cm DW as adult); Indo–Malay Archipelago, freshwater and estuarine .... ***Fluvitrygon* (3 species; fig. 10, pp. 542–544)**

   Disc rhombic (fig. 11) or broadly oval (fig. 12) with angular to narrowly rounded pectoral-fin apices (but more broadly rounded in *H. undulata*); tail with faint alternating light and dark bands beyond caudal sting in young; disc rather thick without large fleshy lobe at its tip (fig. 11); large rays (>100 cm DW as adult); Indo–West Pacific, estuarine and marine .... ***Himantura* (4 species; figs 11, 12, pp. 561–564)**

fig. 10

dark spots

fig. 11

ocelli

fig. 12

6. Disc rhombic (fig. 17) with angular to narrowly rounded pectoral-fin apices (but broadly rounded in *M. pastinacoides*); snout short to moderately elongate, length <2.7 times combined length of orbit and spiracle (fig. 13); tail with alternating black and white bands beyond caudal sting in young, and often subadults; skin on dorsal surface with white and/or black spots (fig. 17) (plain in *M. pastinacoides* and *M. randalli*); Indo–West Pacific .... ***Maculabatis* (9 species; fig. 17, pp. 573–581)**

   Disc oval to almost circular (fig. 14) with broadly rounded pectoral-fin apices (but rhombic with narrowly rounded apices in *Pateobatis fai* and *P. jenkinsii*, fig. 13); snout moderately elongate to very long, length up to 5.5 times combined length of orbit and spiracle (fig. 16) (short in *Himantura granulata*); tail plain without alternating light and dark bands beyond caudal sting (fig. 15); skin on dorsal surface typically plain or with a few white flecks, not spotted 7

7. Disc broadly rhombic (broader than long, fig. 15) with narrowly rounded pectoral-fin apices; snout moderately elongate, 1.7–2.5 times combined length of orbit and spiracle; mouth and nasal curtain relatively broad (fig. 13); Indo–Pacific .... ***Pateobatis* (in part, *P. fai* & *P. jenkinsii*; fig. 15, pp. 600, 602)**

   Disc oval (fig. 16) to almost circular (fig. 18), usually slightly longer than broad with broadly rounded pectoral-fin apices; snout elongate, 2.5–5.5 times combined length of orbit and spiracle (fig. 16), in all but *Himantura granulata;* mouth and nasal curtain rather narrow (fig. 14) 8

fig. 13

fig. 14

fig. 15

fig. 16

fig. 17

8. Disc more or less oval and quite depressed, snout broadly triangular (fig. 16); Indo–West Pacific .... ***Pateobatis*** **(in part, 3 species; fig. 16, pp. 599–603)**

   Disc subcircular and robust through trunk, snout obtuse (fig. 18), (except in *Himantura lobistoma*); Indo–West Pacific .... ***Urogymnus*** **(in part, 5 species; fig. 18, pp. 613–618)**

9. Ventral skin fold on tail tall, extending to tip of tail (fig. 19) 10

   Ventral skin fold on tail low (fig. 20), or if tall not extending to tip of tail (fig. 21) 11

10. Skin on dorsal surface covered with bright blue spots (fig. 26); nasal curtain long and narrow (fig. 22); paired rows of enlarged teeth in upper jaw (fig. 24); 2 large papillae on floor of mouth (fig. 25); small stingrays (<40 cm DW); Indo–West Pacific .... ***Taeniura*** **(2 species; fig. 26, pp. 605–606)**

    Skin on dorsal surface uniformly dark or covered with black and white blotches (fig. 27); nasal curtain short and broad (fig. 23); no enlarged tooth rows in upper jaw; several large papillae on floor of mouth; large stingrays (>100 cm DW as adults); Eastern Atlantic and Indo–West Pacific .... ***Taeniurops*** **(2 species; fig. 27, pp. 607–608)**

fig. 18

fig. 19

fig. 20

fig. 21

side view of tail near caudal sting

fig. 22 fig. 23

oronasal region

fig. 24

teeth of upper jaw

fig. 25

floor of mouth

fig. 26

11. Ventral skin fold on tail relatively long and tall (fig. 21), height more than height of tail (usually twice or more) at its mid-length; fold ending abruptly posteriorly then tail forming a short flexible filament (fig. 28); caudal sting located well posteriorly on tail (figs 28, 29), horizontal distance from insertion of disc to sting origin >4 times interspiracular distance **12**

    Ventral skin fold on tail variable in length and narrow (fig. 20), height usually less than height of tail at its mid-length; caudal sting located more anteriorly on tail (fig. 30), horizontal distance from insertion of disc to sting origin <3.5 times interspiracular distance .. **13**

12. Disc more or less rhombic, pectoral-fin apices usually angular or narrowly rounded (fig. 28); skin on dorsal surface rough with a diffuse-edged denticle band on central disc; horizontal distance from insertion of disc to sting origin 3.5–4.6 times interspiracular distance; Indo–West Pacific, marine and estuarine .... ***Pastinachus* (5 species; fig. 28, pp. 594–598)**

    Disc almost oval, pectoral-fin apices broadly rounded (fig. 29); skin on dorsal surface velvety, without a prominent denticle band on central disc; horizontal distance from insertion of disc to sting origin ~5.3 times interspiracular distance (fig. 29); South-East Asia, freshwater .... ***Makararaja* (1 species; fig. 29, p. 582)**

13. Disc shape resembling broad flattened cone (fig. 30), with its anterior margin uniformly rounded (fig. 30); dorsal and ventral surfaces of body both entirely dark (dark brown or black); cosmopolitan .... ***Pteroplatytrygon* (1 species; fig. 30, p. 604)**

    Disc oval to subcircular (fig. 33), or rhombic (figs 34, 35), but not cone-shaped, margin typically angular anteriorly (fig. 34); ventral surface whitish (may be dark-edged), distinctly paler than dorsal surface................ **14**

fig. 27

sting

fig. 28

fig. 29

sting

fig. 30

14. Tail distinctly banded black and white toward tail tip (fig. 31); dark transverse band near eyes (occasionally faint) (fig. 31); 2 oral papillae on floor of mouth (fig. 25); Indo–West Pacific .... ***Neotrygon*** **(10 species; fig. 31, pp. 584–593)**

    Tail not obviously banded behind sting; no dark transverse band around eyes; typically more or less than 2 oral papillae on floor of mouth (*Hemitrygon laevigata* has 1–4) **15**

15. Snout rather long and pointed, length usually exceeding 3 times combined orbit and spiracle length (fig. 32); no oral papillae on floor of mouth; Indo–West Pacific .... ***Telatrygon*** **(4 species; fig. 32, pp. 609–612)**

    Snout typically shorter, length <3 times combined orbit and spiracle length (except in *Hypanus geijskesi* and *H. colarensis*); 1–7 fleshy oral papillae present on floor of mouth **16**

16. Disc oval to almost circular (fig. 33); anterior snout tip extended slightly or forming a long, narrow lobe; pelvic fins rather small and fully or almost entirely concealed by disc in dorsal view (fig. 33), except in *Fontitrygon geijskesi*; Atlantic, marine, estuarine and freshwater .... ***Fontitrygon*** **(6 species; fig. 33, pp. 545–550)**

    Disc rhombic (fig. 34, 35); pelvic fins comparatively large and projecting slightly or well behind disc in dorsal view (fig. 34) **17**

17. Disc very broadly angular (fig. 34), width 1.4–1.5 times its length; tail extremely broad at base, its width tapering greatly at caudal sting (fig. 34); tail base width much more than twice eye diameter; Indo–West Pacific .... ***Megatrygon*** **(1 species; fig. 34, p. 583)**

    Disc apices angular (fig. 35) to rounded (fig. 38), width 1.3 times or less its length; tail not as above; tail base width less than twice eye diameter **18**

fig. 31

fig. 32

fig. 33

fig. 34

fig. 35

18. Tail broad-based and depressed (fig. 35); snout moderately short (fig. 35), length 1.5–2.5 times combined orbit and spiracle length; tail firm with large tubercles and thornlets (fig. 35) (not always confined to mid-line before sting, but absent in very young); enormous rays (attaining more than 2 m DW); cosmopolitan .... ***Bathytoshia*** **(3 species; fig. 35, pp. 530–532)**

    Not as above for all characters **19**

19. Tail moderately broad-based and depressed (fig. 36); snout short (fig. 36), length 1–1.5 times combined orbit and spiracle length; upper surface of disc largely smooth without thorns and rarely with any denticles; pelvic fins large and projecting well behind disc in dorsal view (fig. 36); some with strong colour pattern (fig. 36); medium-sized rays (adults smaller than 1 m DW); Atlantic and Western Indian Oceans .... ***Dasyatis*** **(5 species; fig. 36, pp. 537–541)**

    Not as above for all characters **20**

20. Thorns in prominent row on nape and 1 or more thorns on shoulder in adults (fig. 37); ventral surface uniformly white or posterior edges of disc blackish, greyish or reddish; small to very large rays (adults 30 cm to almost 2 m DW); Atlantic and Eastern Pacific .... ***Hypanus*** **(8 species; fig. 37, pp. 565–572)**

    Thorn row on nape present, weak or absent, often no thorns on shoulder (fig. 38); ventral surface uniformly white or posterior edges of disc yellowish or orange; small to medium-sized rays (adults smaller than 1 m DW); Western Pacific and Eastern Indian Oceans .... ***Hemitrygon*** **(10 species; fig. 38, pp. 551–560)**

fig. 36

thorn rows

fig. 37

fig. 38

SMOOTH STINGRAY

25.1

Bathytoshia brevicaudata (Hutton, 1875)

LC

IDENTIFICATION. Huge, largely plain-coloured stingray with a broad rhombic disc, transverse groove on belly, short tail that tapers strongly before caudal sting, thorns when present confined to tail before sting, and oblique row of white spots at base of each pectoral fin on dorsal surface. Disc width ~1.1–1.2 times its length, trunk very thick; pectoral-fin apex narrowly rounded. Snout short, obtuse, tip barely extended, anterior margins weakly convex. Eyes small, length of orbit and spiracle 2–2.2 in snout length; interorbital space broad, up to 4 times orbit length in adults. Mouth usually with 5–7 oral papillae; labial furrows deep; lower jaw weakly convex. Nasal curtain very broadly skirt-shaped, margin fringed; nostrils oval, oblique. Skin lacking dermal denticles, smooth at all stages of growth; specimens exceeding ~45 cm DW with a row of spear-shaped or starry-based thorns and tubercles on mid-line of tail before caudal sting; tail beyond sting covered with sharp thornlets. Tail very broad and depressed at base, usually shorter than disc width; usually with 1 long caudal sting; ventral fold short but prominent (extending to just beyond sting tip), dorsal fold reduced to a hard ridge. Pelvic fins rather small, apices narrowly rounded.

COLOUR. Uniform greyish brown above; darkest on tail tip and above eye; inside of spiracles, pores around side of head, and diagonal row of pores on each side of anterior disc white. Ventral surface white; margin of disc and undersurface of tail usually dusky.

SIZE. Attains at least 210 cm DW (~430 cm TL) and possibly 350 kg; born at 32–36 cm DW.

HABITAT AND BIOLOGY. Antitropical in Indo–Pacific; southern Africa to New Zealand, and off Japan and Peter the Great Bay (eastern Russia). Demersal on soft bottoms usually shallower than 150 m in Australia, but commonly deeper off South Africa, at 180–480 m depths. Litters of 6–10 pups. Feeds on invertebrates and small fishes.

SIMILAR SPECIES. Occurs together with the Brown Stingray (25.3) but differs from this species in having a shorter and less spiny tail, and a diagonal row of white spots on each side of the disc. Previously placed in the genus *Dasyatis*, and North-West Pacific populations were known as *Dasyatis matsubarai* Miyosi.

ROUGHTAIL STINGRAY

25.2

Bathytoshia centroura (Mitchill, 1815)

LC

IDENTIFICATION. Huge, plain-coloured stingray with a broad rhombic disc, central disc with bucklers, tail very thorny in adults, tail moderately elongate and gently tapering to caudal sting, slender ventral tail fold and no dorsal skin fold, and plain brownish upper surface. Disc width ~1.2–1.3 times its length, trunk thick; pectoral-fin apex narrowly rounded to abruptly angular. Snout short, broadly triangular, tip barely extended, anterior margins weakly undulate. Eyes small, length of orbit and spiracle 1.5–2.5 in snout length; interorbital space broad, ~3–3.3 times orbit length in adults. Mouth broad, usually with 6 oral papillae; labial furrows weak; lower jaw weakly convex. Nasal curtain very broadly skirt-shaped, margin weakly fringed; nostrils oval, oblique. Skin of juveniles (<50 cm DW) smooth; larger specimens with stellate thorns and tubercles on mid-line of disc and tail, smaller thorns on snout and laterally on disc; tubercles on tail similar in size to eye; tail beyond sting slender, very thorny on all surfaces. Tail broad and depressed at base, length ~1.6–1.8 times DW; tapering gradually to sting; 1–3 caudal stings; ventral fold long, low (base about equal to distance from cloaca to sting base). Pelvic fins rather small, apices abruptly rounded.

COLOUR. Dorsal surface uniform olive brown to dark brown; no diagonal row of white pores on disc; tail mostly dark before caudal sting above, usually with white base ventrally; all surfaces black beyond sting. Ventral surface entirely white; ventral fold dark.

SIZE. Possibly attains 220 cm DW. Males mature at 130–150 cm DW, females 140–160 cm DW; born at 34–37 cm DW.

HABITAT AND BIOLOGY. Western Atlantic, antitropical; western and southern USA (including Gulf of Mexico), and Brazil to Argentina. Demersal on soft bottoms, usually shallower than 100 m depth, but recorded from 275 m. Litters of 2–6 pups. Feeds mainly on bony fishes, crabs, bivalves, gastropods and cephalopods.

SIMILAR SPECIES. Closely related to the Brown Stingray (25.3) from the Eastern Atlantic and Indo–Pacific, and its relationship to that species needs further investigation. Previously placed in the genus *Dasyatis*.

BROWN STINGRAY

25.3

Bathytoshia lata (Garman, 1880)

LC

IDENTIFICATION. Huge, plain-coloured stingray with a broad rhombic disc, sharp thorns over disc and tail of adults, moderately elongate and gently tapering tail to caudal sting, slender ventral tail fold and minute dorsal fold, and upper surface plain greyish brown or black. Disc width ~1.2–1.3 times its length, trunk very thick; pectoral-fin apex narrowly rounded to angular. Snout short, broadly triangular, tip extended slightly, anterior margins weakly undulate. Eyes small, length of orbit and spiracle 2.1–2.5 in snout length; interorbital space broad, up to 4.5 times orbit length in adults. Mouth broad with 3–5 oral papillae; labial furrows weak; lower jaw weakly convex. Nasal curtain very broadly skirt-shaped, margin fringed; nostrils oval, oblique. Skin of juveniles (<60 cm DW) smooth, sometimes with stellate thorns on mid-line of disc; thorns more upright and pointed on back and snout, some on tail enlarged with broader bases; larger specimens finely granular with denser coverage of large thorns centrally; tail beyond sting very thorny. Tail broad and depressed at base, length about twice DW; tapering gently to sting; usually 1 caudal sting; ventral fold long, low (base about equal to precloacal length); dorsal fold barely detectable. Pelvic fins rather small, apices angular.

COLOUR. Uniform greyish brown to blackish; no obvious diagonal row of white pores on disc but often with irregular white flecks where skin is damaged. Tail dark before sting above, usually with white base ventrally; all surfaces black beyond sting. Ventral surface entirely white; ventral fold black.

SIZE. Possibly attains 260 cm DW and 290 kg. Males mature at ~100 cm DW, females ~110 cm DW, born at ~35 cm DW, but these data need substantiating.

HABITAT AND BIOLOGY. Eastern Atlantic (southern France to Angola, including Mediterranean Sea) and widespread in Indo–Pacific (southern Africa to Hawaii). Mainly demersal on continental and insular shelves, also occurs on upper slopes to 800 m depth. Feeds on crabs, prawns and small bony fishes.

SIMILAR SPECIES. Large Indo–Pacific stingrays, previously known as *Dasyatis thetidis*, *D. ushiei*, and Eastern Atlantic populations of *D. centroura*, are the same as this species. However, the Western Atlantic Roughtail Stingray (25.2) is a closely related but distinct species. Previously placed in the genus *Dasyatis*.

DWARF WHIPRAY

25.4

Brevitrygon heterura (Bleeker, 1852)

NE

IDENTIFICATION. Very small whipray with an oval disc, pointed snout, broad almost rectangular denticle band in adults, no enlarged mid-shoulder denticles, tail short (tip bulbous in adult females) with median row of enlarged spear-shaped thorns, no skin folds on tail, and dorsal surface plain coloured. Disc only slightly longer than wide, length ~1–1.1 times DW; pectoral-fin apex broadly rounded. Snout rather long, broad, apical lobe narrowly rounded, anterior margins moderately concave. Eyes small, protruding slightly, length of orbit and spiracle ~2.9–3.1 in snout length; interorbital space rather broad, 1.2–2.1 times orbit length. Mouth moderately arched, 2–3 well-developed oral papillae (well separated); lower jaw arched with central concavity. Nasal curtain skirt-shaped, broad, posterior margin finely fringed. Mid-shoulder denticle weak; denticle band expanded over abdomen in adults, converging forward of orbits and tail, and constricted beside spiracles; skin smooth outside denticle band. Thorns in median row on tail 4–6, enlarged with convex crowns. Tail short to moderately elongate, length 1–1.7 times DW; depressed, stout at base but filamentous beyond caudal sting in young and adult males, bulbous with short filamentous tip in large females; 1 or 2 caudal stings.

COLOUR. Dorsal surface pale greenish brown, margin of disc pale; tail greenish brown above and white below forward of caudal sting, pale yellowish with narrow white stripe along lateral edge behind sting. Ventral surface white, disc margins dusky.

SIZE. Attains at least 24 cm DW (~46 cm TL). Males mature at 16–18 cm DW and females 17 cm DW; born at 8–10 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Java and Borneo to western Thailand. Demersal on inner continental and insular shelf to ~50 m depth. Litters of 1–2 pups. Feeds mainly on small crustaceans and fishes.

SIMILAR SPECIES. Belongs to a group of small inshore whiprays previously placed in the genus *Himantura*. Range overlaps with the similar Javan Whipray (25.6), but the Dwarf Whipray differs in having a short row of spear-shaped thorns on the tail (otherwise absent).

BENGAL WHIPRAY 25.5

Brevitrygon imbricata (Bloch & Schneider, 1801)

DD

IDENTIFICATION. Very small whipray with a suboval disc, pointed snout, interspiracular distance 18–19% DW, broad almost rectangular denticle band in adults, no enlarged mid-shoulder denticles, tail moderately elongate (posterior half wider in adult females) with a row of spear-shaped thorns, tail with median grooves on both upper and lower surfaces and fleshy ridges along sides (no folds), and dorsal surface plain coloured. Disc slightly longer than wide, length ~1.1 times DW; pectoral-fin apex broadly rounded. Snout rather long, broad, apical lobe pointed, anterior margins deeply concave. Eyes small, protruding slightly, length of orbit and spiracle 2.9–3.6 in snout length; interorbital space rather broad, ~2 times orbit length. Mouth weakly arched, 2 minute oral papillae; lower jaw arched with deep central concavity. Nasal curtain skirt-shaped, broad, posterior margin finely fringed. Mid-shoulder denticles barely larger than denticles adjacent; denticle band expanded over abdomen in adults, constricted beside spiracles; skin smooth outside denticle band. Up to 6 enlarged thorns on tail, crowns low and narrow. Tail moderately elongate, length 1.5–1.7 times DW; stout and oval in cross-section at base; filamentous beyond caudal sting in young and adult males, more flattened posteriorly in large females; usually 2 caudal stings.

COLOUR. Dorsal surface brownish to greenish brown, margin of disc slightly paler. Tail forward of caudal sting brownish above and white below; lateral ridges white, demarcated and separated by darker upper and lower surfaces of tail behind sting. Ventral surface of disc white, disc and pelvic margins yellowish brown.

SIZE. Attains at least 23 cm DW (~49 cm TL); males mature at ~15 cm DW.

HABITAT AND BIOLOGY. Northern Indian Ocean; Bay of Bengal, but possibly further south in Andaman Sea. Demersal on inner continental shelf to at least 55 m depths. Poorly known and more information needed to assess habitat requirements and life history.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Resembles the Dwarf Whipray (25.4) but usually has a longer tail and more widely separated spiracles.

JAVAN WHIPRAY

25.6

Brevitrygon javaensis (Last & White, 2013)

NE

IDENTIFICATION. Very small whipray with a suboval disc, pointed snout, broad uneven denticle band in adults, mid-shoulder denticle(s) distinct, tail elongate (tip not bulbous in adult females) and lacking enlarged thorns, no skin folds on tail, and dorsal surface plain coloured. Disc strongly flattened, length subequal to width; pectoral-fin apex broadly rounded. Snout rather long, apical lobe narrowly pointed, anterior margins strongly concave. Eyes small, protruding slightly, length of orbit and spiracle ~3–3.1 in snout length; interorbital space rather broad, 1.9–2.5 times orbit length. Mouth arched, narrow, 4 well-developed oral papillae (2 centrally, others near jaw angle); lower jaw strongly arched with central concavity. Nasal curtain broadly skirt-shaped, posterior margin finely fringed. Mid-shoulder denticles 1–3 (usually 1), seed- or heart-shaped; denticle band expanded over abdomen in adults, converging forward of tail, and variably constricted beside spiracles; skin smooth outside denticle band. No thorns on tail. Tail base depressed, rather stout, filamentous beyond caudal sting in both sexes; length 2.1–2.2 times DW; probably 1 or 2 caudal stings (removed from most available specimens).

COLOUR. Upper surface uniformly brownish, disc margin slightly paler brown. Ventral disc and tail white with dark margins on pectoral and pelvic fins, and dark blotches over first four gill slits.

SIZE. Attains at least 24 cm DW (~72 cm TL). Males mature at 17–18 cm DW, females ~18 cm DW; born at 5–9 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; may be endemic to southern Java. Presumably benthic on soft bottoms near coast. Caught by local fishers in trammel nets.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Unlike the similar Dwarf (25.4) and Scaly (25.7) Whiprays, this species has a largely naked tail, with only a few small denticles at its base and lacks a row of enlarged median thorns. Its distribution overlaps with the Dwarf Whipray in Indonesia.

SCALY WHIPRAY

25.7

Brevitrygon walga (Müller & Henle, 1841)

NT

IDENTIFICATION. Small whipray with a suboval disc, pointed snout, interspiracular distance 17.1–18% DW, narrow denticle band in adults, mid-shoulder denticle narrow and heart-shaped, tail short with row of enlarged spear-shaped thorns, ridge-like ventral fold on tail and no dorsal fold, and dorsal surface plain coloured with pale margins. Disc slightly longer than wide, length usually 1–1.1 times DW; pectoral-fin apex broadly rounded. Snout long, broadly concave, with distinct apical lobe, anterior margins strongly concave. Eyes small, protruding slightly, length of orbit and spiracle ~2.6–3 in snout length; interorbital space rather broad, 1.5–2 times orbit length. Mouth arched, 2 central oral papillae (close together); lower jaw arched with central concavity. Nasal curtain almost rectangular, posterior margin finely fringed. Mid-shoulder denticle small; denticle band narrow in both juveniles and adults, extending just forward of orbits and constricted at nape; skin smooth outside denticle band. Thorns in median row on tail with convex crowns, varying in size. Tail rather short, length 1.3–1.5 times DW; depressed slightly, base stout and oval in cross-section, very slender beyond caudal sting in both sexes; folds rudimentary or absent; 1–3 caudal stings.

COLOUR. Dorsal surface uniform dark brownish, margin of disc pale; tail forward of caudal sting dark brown above and white below, uniformly brownish beyond sting. Ventral surface white, disc margins dusky.

SIZE. Attains at least 32 cm DW (~70 cm TL). Males mature at ~20 cm DW, females ~22 cm DW; born at 7–10 cm DW.

HABITAT AND BIOLOGY. Northern Indian Ocean; Red Sea to western India, including Persian Gulf. Demersal inshore on soft bottoms. Probably feeds on small crustaceans.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. More than 1 form of this species exists in the Indian Ocean and more material is needed to determine levels of intraspecific variability. Historically, it has been confused with all other dwarf whiprays (genus *Brevitrygon*).

BLUE STINGRAY

25.8

Dasyatis chrysonota (Smith, 1828)

LC

IDENTIFICATION. Medium-sized stingray with a broad rhombic and naked disc, snout angle 119–122°, tail short and gradually tapering before caudal sting with narrow dorsal and ventral tail folds, and upper surface brown covered with vivid blue marbling. Disc width 1.1–1.2 times its length and more than 1.25 times precloacal length; pectoral-fin apex rounded to abruptly angular. Snout short, broadly angular, tip extended slightly, anterior margins almost straight. Eyes rather large, protruding, length of orbit and spiracle 1.1–1.3 in snout length; interorbital space ~1.4–1.5 times orbit length. Mouth with 3 oral papillae centrally and 1 at each corner; labial furrows shallow; lower jaw convex, concave at symphysis. Nasal curtain small, skirt-shaped, margin strongly fringed; nostrils oval, oblique. Skin typically naked, except largest adults with sparse denticles on disc and small prickles on posterior tail. No thorns or bucklers. Tail length less than twice DW; rather broad based, depressed, narrowing and becoming filamentous beyond caudal sting; ventral fold short, its base ~30% DW; dorsal fold about half length of ventral fold; usually 1 caudal sting. Pelvic fins broad, apices rather broadly rounded.

COLOUR. Disc golden brown above, overlain with complex blue marbling; edge of disc and tail greyish blue. Ventral surface uniformly white, margins of disc and pelvic fins dusky in young. Tail tip and skin folds dark.

SIZE. Attains 75 cm DW. Males mature at ~41 cm DW, females 50 cm DW; born at 17–20 cm DW.

HABITAT AND BIOLOGY. South-East Atlantic and South-West Indian Ocean; off southern Africa. Mainly coastal and estuarine in summer, moving offshore to mid-continental shelf (to 110 m depth) in winter. Litters of 1–5 pups. Feeds on sea lice, crabs, marine worms and small bottom-dwelling fishes.

SIMILAR SPECIES. Very similar to the Marbled Stingray (25.10) from the tropical Eastern Atlantic, but is larger, and has a relatively shorter disc and more obtuse snout.

GROOVEBELLY STINGRAY

25.9

Dasyatis hypostigma Santos & Carvalho, 2004

DD

IDENTIFICATION. Medium-sized, plain-coloured stingray with a rhombic disc, transverse groove on belly, skin usually naked, tail variably short and strongly tapering before caudal sting, and dorsal and ventral tail folds well developed. Disc width ~1–1.2 times its length, trunk thick; pectoral-fin apex narrowly rounded to abruptly angular. Snout short, broadly angular, tip barely extended, anterior margins almost straight. Eyes medium-sized, protruding, length of orbit and spiracle 1.4–1.5 in snout length; interorbital space ~3 times orbit length. Mouth with 5–7 oral papillae, 3 centrally; labial furrows shallow; lower jaw convex with indented symphysis. Nasal curtain small, weakly bilobed, margin strongly fringed; nostrils slit-like, oblique. Skin of disc lacking thorns and denticles in all but largest individuals; an adult female with patch of small thorns on posterior disc and anterior tail. Tail length 1.3–2.3 times DW; broad and depressed at base, narrowing and becoming filamentous beyond caudal sting; ventral fold long and low; dorsal fold low and firm, often taller than ventral fold; 1 or 2 caudal stings. Pelvic fins small, apices rather broadly rounded.

COLOUR. Uniform brown to olive brownish above, slightly darker over mid-disc, interorbital region and mid-tail; lacking a row of white spots at base of each pectoral fin. Ventral surface mostly white, sometimes with sparse dusky blotches near gills and on mid-disc; margins of disc and posterior margins of pelvic fins dark. Skin folds and posterior tail black.

SIZE. Attains ~58 cm DW; male type specimen an adult, 45 cm DW.

HABITAT AND BIOLOGY. South-West Atlantic; central Brazil to Uruguay. Coastal, estuarine to offshore on continental shelf at 5–80 m depths, but most common at 5–40 m. Life history information unknown due to confusion with other species.

SIMILAR SPECIES. Shares with the much larger Smooth Stingray (25.1) a similar body shape and wavy transverse groove on the belly behind the gills, but lacks a row of white spots on the pectoral fin. Only member of the genus in the Western Atlantic.

MARBLED STINGRAY

25.10

Dasyatis marmorata (Steindachner, 1892)

DD

IDENTIFICATION. Small stingray with a broad rhombic and largely naked disc, snout angle 106–113°, tail short and gradually tapering before caudal sting, low dorsal and ventral tail folds, and brown upper surface covered with vivid blue marbling. Disc width 1.1 times its length and less than 1.3 times precloacal length; pectoral-fin apex rounded to abruptly angular. Snout short, broadly angular, tip extended slightly, anterior margins almost straight. Eyes rather large, protruding, length of orbit and spiracle more than 1.3 in snout length; interorbital space ~1.3 times orbit length. Mouth with 3 oral papillae centrally and usually 1 at each corner; labial furrows pronounced; lower jaw convex, weakly concave at symphysis. Nasal curtain small, skirt-shaped, margin strongly fringed; nostrils oval, oblique. Skin entirely naked without denticles, thorns or bucklers. Tail length slightly more than twice DW; rather broad based, depressed, narrowing and becoming filamentous beyond caudal sting; ventral fold short, base ~38% DW; dorsal fold usually more than half length of ventral fold; usually 1 caudal sting. Pelvic fins broad, apices broadly rounded.

COLOUR. Brownish above with pale blue marbling over most of central disc; broad pale pink margin around disc and pelvic fins, outer margin of eye white; tail darker, greyish brown. Ventral surface uniformly white. Dorsal skin fold dark; ventral fold white.

SIZE. Attains ~38 cm DW; males mature at ~27 cm DW.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Mauritania to Congo (possibly also Eastern Mediterranean Sea). Not well known, but probably benthic in coastal habitats and on inner continental shelf to at least 40 m depth.

SIMILAR SPECIES. Resembles the larger Blue Stingray (25.8) but has a relatively longer disc and a narrower and more angular snout (angle less than 115° rather than 119° or more). Also once confused with another *Dasyatis* from the Mediterranean Sea, the Common Stingray (25.11), which is plainly coloured (rather than a prominent, blue-marbled dorsal colour pattern).

COMMON STINGRAY

25.11

Dasyatis pastinaca (Linnaeus, 1758)

DD

IDENTIFICATION. Small to medium-sized stingray with a broad rhombic and mostly naked disc, teeth with smooth crowns, tail short and strongly tapering at caudal sting, dorsal and ventral tail folds short and deep, nostrils pale-edged, and upper surface plain brownish, olive or greyish. Disc width 1.1–1.2 times its length; pectoral-fin apex abruptly angular. Snout short, broadly angular, tip lobe-like; anterior margins almost straight. Eyes medium-sized, protruding slightly, length of orbit and spiracle ~2 in snout length; interorbital space 1.8–2 times orbit length. Mouth with 5 large oral papillae, 3 centrally; labial furrows and papillae weak; lower jaw slightly convex, weakly concave at symphysis; preoral length less than 1.4 times spiracle length. Nasal curtain small, skirt-shaped, margin fringed; nostrils oval, oblique. Skin usually entirely naked; very large females sometimes with scattered thornlets on median disc and tail. Tail length 1.3–1.5 times DW; broad and depressed at base, narrowing and becoming filamentous beyond caudal sting; dorsal fold often taller than ventral fold; usually 1 large caudal sting. Pelvic fins broad and extending rearward well behind disc, apices broadly rounded.

COLOUR. Brownish, olive to dark greyish above, usually paler around disc margin and on pelvic fins but lacking bluish markings; large specimens with contrasting gold markings around eye; median tail dark. Skin folds and outer half of tail dark. Ventral surface of disc uniformly white, no dark edges around nostrils and nasal curtain.

SIZE. Attains ~68 cm DW, reports to 140 cm DW are dubious. Males mature at 30–31 cm DW, females 38–41 cm DW; born at ~12 cm DW.

HABITAT AND BIOLOGY. North-East Atlantic (British Isles to Mauritania) and Mediterranean Sea. Coastal and continental shelf to 140 m depth, but mostly shallower than 50 m. Litters of 3–7 pups. Feeds mainly on crustaceans.

SIMILAR SPECIES. Differs subtly from Tortonese's Stingray (25.12) in colour, body dimensions and dentition (crowns of the teeth are smooth in the Common Stingray rather than corrugated). Specimens from the eastern Mediterranean, off Israel, differ slightly and need further investigation.

TORTONESE'S STINGRAY

25.12

Dasyatis tortonesei Capapé, 1977

NE

IDENTIFICATION. Medium-sized stingray with a rhombic and mostly naked disc, teeth with corrugated crowns, tail short and strongly tapered before caudal sting, ventral tail fold long and low, dorsal fold reduced to ridge, nostrils dark-edged, and upper surface plain yellowish. Disc width 1.2–1.3 times its length; pectoral-fin apex narrowly rounded. Snout short, broadly angular, tip extended slightly, anterior margins straight to weakly undulate. Eyes medium-sized, protruding slightly, length of orbit and spiracle 1.6–1.9 in snout length; interorbital space 1.1–1.3 times orbit length. Mouth usually with 3 filamentous oral papillae; labial furrows and papillae pronounced; lower jaw convex, concave at symphysis; preoral length more than 1.4 times spiracle length. Nasal curtain small, skirt-shaped, margin strongly fringed; nostrils oval, oblique. Skin entirely naked in young, some denticles and broad-based tail thorns in large adults. Tail length 1.2–1.4 times DW; broad and depressed at base, narrowing greatly and becoming filamentous beyond sting; dorsal ridge elongate and lower than ventral fold; usually 1 large caudal sting. Pelvic fins narrow, extending well rearward of disc, apices broadly rounded.

COLOUR. Uniform yellowish above, often darker greyish around eye and spiracle; skin folds and end of tail blackish. Ventral surface of disc white, tail dark brown, nostrils and nasal curtain usually with dark edges; disc and pelvic fins with sharply defined dark edges.

SIZE. Attains ~84 cm DW, but usually smaller than 65 cm DW. Males mature at 35–38 cm DW, females 46–47 cm DW; born at 15–16 cm DW.

HABITAT AND BIOLOGY. North-East Atlantic; France to Mauritania, including Western Mediterranean Sea. Mainly coastal and estuarine on soft bottoms, shallower than ~100 m depth. Litters of 3–9 pups. Feeds on benthic crustaceans, molluscs and fishes.

SIMILAR SPECIES. Once considered to be identical to the Common Stingray (25.11). They differ subtly in the shape of the dorsal skin fold, form and number of oral papillae, and in some aspects of disc shape.

ROUGHBACK WHIPRAY

25.13

Fluvitrygon kittipongi (Vidthayanon & Roberts, 2006)

EN

IDENTIFICATION. Small, plain-coloured whipray with an oval disc, short narrow lobe on snout, small eyes, nasal curtain broadly skirt-shaped, broad band of denticles on central disc, enlarged pearl thorn on mid-shoulder region, enlarged thorny denticles on mid-line of tail before caudal sting, tail whip-like and without skin folds, and tail not banded. Disc rather thick through trunk, longer than wide, length ~1.1 times DW; pectoral-fin apex broadly rounded. Snout broad, rather long; apical lobe prominent; anterior margins straight. Eye small, protruding slightly, length of orbit and spiracle 2.8–3.2 in snout length; interorbital space 2.1–2.4 times orbit length. Mouth small with 4–5 oral papillae; labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain posterior margin finely fringed. Mid-shoulder denticles sparse, dense within well-defined band. Tail rather narrow-based, flattened and oval in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 1.3–1.8 times DW; 1 or 2 caudal stings; tail beyond caudal sting densely covered with denticles.

COLOUR. Dorsal surface light grey to deep orange brown with narrow white marginal band; pale spots anterior of orbits and posterior of spiracles; tail white with blackish spots or black overall behind sting. Ventral surface white with narrow brownish margin behind mouth level. Outer teeth band in both jaws usually stained orange in adults.

SIZE. Attains at least 37 cm DW (~96 cm TL); males probably mature at ~22 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Thailand and Borneo. Benthic in freshwater and brackish habitats, probably on muddy and silty bottoms. Feeds on small bottom-dwelling invertebrates such as crustaceans. Caught incidentally and used for its meat.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Most similar to the White-edge Whipray (25.15), also from the Indo–Malay Archipelago, but differs in having enlarged thorny denticles on the tail (*vs.* no enlarged denticles on tail).

MARBLED WHIPRAY

25.14

Fluvitrygon oxyrhynchus (Sauvage, 1878)

EN

IDENTIFICATION. Small whipray with an elongate oval disc, very long and narrowly pointed snout, very small eyes, nasal curtain skirt-shaped, large pearl thorn(s) and band of denticles on central disc in adults, tail whip-like without skin folds, and an ornate colour pattern of reticulations and spots on the upper disc. Disc with a flattened trunk, longer than wide, length ~1.2 times DW; pectoral-fin apex broadly rounded. Snout long, with very long, pointed apical lobe; anterior margins deeply concave. Eye very small, protruding slightly, length of orbit and spiracle 3.5–3.7 in snout length; interorbital space 2.3–2.7 times orbit length. Mouth small, arched with 2–5 oral papillae, in 2 transverse rows; labial furrows and folds weak; lower jaw arched slightly. Nasal curtain with posterior margin finely fringed. Denticles on central disc sparse when smaller than 15 cm DW; band subrectangular and narrow on tail in adults. Mid-shoulder thorns 1 or 2; smaller seed thorns sometimes on middle of tail. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; very long, length 3–3.6 times DW; often with 1 caudal sting; tail beyond caudal sting sparsely covered with denticles. Pelvic fins narrowly triangular.

COLOUR. Dorsal surface of disc with rich and variable pattern, brownish, usually covered with fine dark markings, spots and reticulations; tail similar with dark markings extending to its tip (no distinct bands). Ventral surface white, lateral margins and hind edges of pelvic fins usually greyish or black.

SIZE. Attains ~37 cm DW (exceeding 126 cm TL); size at maturity unknown; born at ~9 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Thailand, Cambodia and Borneo, in freshwater habitats. Common in lowland rivers and streams on soft bottoms. Probably feeds mainly on riverine invertebrates. Used in the aquarium trade.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Confused with juveniles of the much larger *Himantura* whiprays, i.e. the Leopard (25.33), Coach (25.34), and Honeycomb (25.35) Whiprays, which can have a similar colour pattern, but the Marbled Whipray differs in having a more elongate oval disc, much longer snout, and richer colour pattern at the same size.

WHITE-EDGE WHIPRAY

25.15

Fluvitrygon signifer (Compagno & Roberts, 1982)

EN

IDENTIFICATION. Small whipray with an oval to subcircular disc, very short lobe on snout, small eyes, nasal curtain skirt-shaped, diffuse and narrow denticle band in adults, no enlarged mid-shoulder denticles or thorny denticles elsewhere on disc or tail, very long and whip-like tail without skin folds, white-edged upper disc with plain or weak reticulate colour pattern, and tail not banded. Disc rather broad through trunk, slightly longer than wide, length 1–1.1 times DW; pectoral-fin apex broadly rounded. Snout broad, obtuse, moderate length; apical lobe weak, anterior margins straight to weakly convex. Eye small, protruding slightly, length of orbit and spiracle 2.2–2.3 in snout length; interorbital space 2.1–2.2 times orbit length; spiracle much larger than eye. Mouth small, 4–5 oral papillae; labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain subrectangular, posterior margin finely fringed. Mid-shoulder denticles absent in adults; denticle band not well defined on disc (narrower than interorbital space), in very narrow band along mid-upper tail to caudal sting. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 3.4–3.8 times DW; often with 2 caudal stings; tail beyond caudal sting sparsely covered with denticles.

COLOUR. Dorsal surface greyish brown with a distinct white marginal band; white spots anterior of orbits and posterior of spiracles; tail white behind caudal sting. Ventral surface white.

SIZE. Attains ~37 cm DW (~134 cm TL). Males mature at ~21–23 cm DW, females 25–26 cm DW; born at 11–12 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Thailand, Sumatra, Peninsular Malaysia and Borneo, known distribution patchy in freshwater habitats. Mainly benthic on muddy bottoms. Feeds on small, benthic invertebrates such as crustaceans, shellfish and insect larvae.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. The Roughback Whipray (25.13), which is also endemic to the Indo–Malay Archipelago, attains a similar size but has a more acute snout and lacks a distinctive pale-edged disc.

COLARES STINGRAY

25.16

Fontitrygon colarensis (Santos, Gomes & Charvet-Almeida, 2004)

VU

IDENTIFICATION. Large, plain brownish stingray with a weakly rhombic disc, very long and narrowly pointed snout, band of denticles on disc, small shoulder thorns and median row of larger thorns on body, triangular pelvic fins, whip-like tail with a low ventral fold and dorsal fold reduced to vestigial ridge or absent. Disc elongate, not robust through trunk, width equal to length; pectoral-fin apex broadly rounded. Snout extended, angular, anterior margins concave. Eyes very small, length of orbit and spiracle 3.6–4 in snout length; interorbital space 4.1–5.3 times orbit length. Mouth very narrow, usually 3 oral papillae; labial furrows and folds distinct; lower jaw convex with concavity at symphysis. Nasal curtain small, weakly bilobed; nostrils short, oval. Denticles forming irregular band over snout, and central disc to tail base. Median thorns well developed, in defined row from nape to caudal sting; 1–3 thorns on each shoulder. Tail thin, barely tapering before sting, length 3.3–3.8 times DW; usually 1 caudal sting; ventral fold slender, shorter than half tail height (base more than 30% pre-sting length). Pelvic fins not greatly extended, length 20–23% DW; apices narrowly rounded.

COLOUR. Uniform pale brown above. Ventral surface greyish, margins of disc and pelvic fins slightly darker; edge of lower lip blackish. Claspers and ventral tail fold dark brown.

SIZE. Attains at least 165 cm DW; males mature at ~63 cm DW.

HABITAT AND BIOLOGY. South-West Atlantic; endemic to northern Brazil. Lives in estuaries and coastal habitats receiving freshwater discharge from Amazon River in dry season, moving further offshore after heavy rain. Litters of 1–4 pups.

SIMILAR SPECIES. Placed provisionally in *Fontitrygon* and needs further evaluation. Resembles the Wingfin Stingray (25.18) in general shape but differs in several body proportions, and has much shorter and less pointed pelvic fins. A very similar unnamed species occurs in the Eastern Pacific Ocean, off Ecuador.

SMOOTH WHIPRAY

25.17

Fontitrygon garouaensis (Stauch & Blanc, 1962)

VU

IDENTIFICATION. Small, plain-coloured stingray with a strongly flattened oval to subcircular disc, snout obtuse with obvious apical lobe, mid-shoulder thorns either irregular and small or absent, denticles confined to small patch on central disc in adults, and whip-like tail with low, fleshy dorsal keel and prominent ventral fold. Disc length 0.9–1 times width; anterior margins distinctly convex, pectoral-fin apex broadly rounded. Snout rather elongate and broad, preorbital length 28–32% DW; apical lobe triangular, small but prominent. Eyes and spiracles small; eyes barely protruding, length of orbit and spiracle ~3.8 in snout length; interorbital space 1.3–2 times orbit length. Mouth very narrow, 5 oral papillae; upper jaw almost straight with 32–40 tooth rows; labial furrows and folds prominent. Nasal curtain small, skirt-shaped and diverging slightly; margin strongly fringed; nostrils slit-like, oblique. Denticles absent or in a central patch on disc, flattened heart-shaped or subcircular. Usually 3–4 low, circular to triangular mid-shoulder thorns in adults. Tail narrow-based, oval, tapering abruptly at caudal sting; long, length 2–2.6 times DW; usually 1 caudal sting; ventral fold long-based and very low. Pelvic fins small, apices narrowly rounded. Pectoral-fin radials 122–125.

COLOUR. Disc and pelvic fins greyish to greyish brown above, without obvious spots or markings; ventral surface uniformly pale or whitish, usually without a dark marginal band. Tail dusky or black, mottled; lighter below with white base; end of tail dusky or blackish.

SIZE. Attains at least 34 cm DW, possibly to 40 cm DW (~100 cm TL).

HABITAT AND BIOLOGY. Eastern Central Atlantic; freshwater systems of Nigeria and Cameroon. Feeds mainly on aquatic insects.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Probably closely related to the Pearl Whipray (25.20) and Daisy Whipray (25.19). Molecular information is needed to confirm their relationships.

WINGFIN STINGRAY

25.18

Fontitrygon geijskesi (Boeseman, 1948)

NT

IDENTIFICATION. Large, brownish stingray with a suboval disc, long and narrowly pointed snout, band of flattened denticles on disc, median row of thorns extending along disc and tail, enlarged and narrowly pointed pelvic fins, tail whip-like with a low ventral tail fold and weak dorsal ridge (no fold). Disc elongate, not robust through trunk, width slightly shorter than length; pectoral-fin apex broadly rounded. Snout extended, angular; anterior margins deeply concave. Eyes minute, length of orbit and spiracle more than 6 in snout length; interorbital space more than 5 times orbit length. Mouth very narrow with single median oral papillae; lower jaw convex, indented at symphysis. Nasal curtain small, margin converging, narrowest beside mouth; nostrils oval. Denticle band broadest on central disc, denticles short, widely spaced, globular with flat crowns; rest of disc smooth. Thorn row on central disc separated from those on tail, tubercles spear-shaped; single thorn on each shoulder. Tail thin, whip-like, barely tapering before caudal sting; length 2–3 times DW; usually 2 short stings; ventral fold slender (base ~20% of body length before sting); cutaneous dorsal ridge low. Pelvic fins very long, 38–43% DW, more than twice as wide as long; extended laterally.

COLOUR. Uniform dark brown above. Ventral surface white, disc margins darker.

SIZE. Attains at least 150 cm DW (~400 cm TL).

HABITAT AND BIOLOGY. Western Central Atlantic; known distribution patchy, from Belize to northern Brazil. Demersal near coast at depths to 30 m during dry season; moving further offshore on continental shelf during wet season, recorded from 80 m depth. Litters of 1–3 pups.

SIMILAR SPECIES. Distinguishable from other stingrays of the Western Central Atlantic by its greatly elongated snout and pointed pelvic fins. Once in the genus *Dasyatis* and now provisionally in *Fontitrygon*, but its placement needs further evaluation. May belong in a separate genus.

DAISY WHIPRAY

25.19

Fontitrygon margarita (Günther, 1870)

EN

IDENTIFICATION. Medium-sized, plain-coloured stingray with a wide oval disc, very broad snout with almost straight anterior disc margins, 1 or more greatly enlarged pearl-like mid-shoulder thorns, broad denticle band on central disc, tail whip-like with low dorsal keel, and prominent ventral fold. Disc rather thick, length subequal to width; pectoral-fin apex broadly rounded. Snout moderately elongate, preorbital length 19–23% DW; obtuse, apical lobe pronounced slightly and triangular. Eyes small, barely protruding, length of orbit and spiracle 1.9–2.1 in snout length; interorbital space 1.8–2.6 times orbit length. Mouth narrow, 5 oral papillae; upper jaw strongly undulated with 26–30 tooth rows; labial furrows and folds prominent. Nasal curtain skirt-shaped, broad; margin finely fringed; nostrils oval, oblique. Denticles flattened heart-shaped or subcircular, in dense band on central third of disc in adults; juveniles smooth. Mid-shoulder region with 1–4 circular pearl thorns, length 5–6 mm. Tail narrow-based, oval, length 1.8–2.5 times DW; usually 1 caudal sting; ventral fold long-based and very low. Pelvic fins small, apices narrowly rounded. Pectoral-fin radials 133–135.

COLOUR. Uniform brown to greenish brown above, without regular spots or markings in adults; prominent yellowish blotch beside spiracle in young. Ventral surface uniformly pale or whitish, disc sometimes with dark marginal band; fold blackish, tail paler below than above.

SIZE. Attains at least 78 cm DW (~166 cm TL).

HABITAT AND BIOLOGY. Eastern Central Atlantic; Senegal to Congo. Occurs in both estuarine and marine habitats to ~60 m depth. Feeds on shrimps, crabs, bivalves and marine worms.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis* because it possesses a central tail fold, but appears to be more closely related to the marine whiprays of the Indo–Pacific. Similar to the smaller Pearl Whipray (25.20) but has a more broadly pointed snout, larger and fewer teeth, and a relatively larger pearl thorn.

PEARL WHIPRAY

25.20

Fontitrygon margaritella (Compagno & Roberts, 1984)

DD

IDENTIFICATION. Small, plain-coloured stingray with an oval disc, narrowly pointed snout with deeply concave anterior margins, enlarged pearl-like mid-shoulder thorn, prominent denticle band on central disc, and whip-like tail with low dorsal keel and prominent ventral fold. Disc weakly arched, length subequal to width; pectoral-fin apex broadly rounded. Snout moderately elongate and narrow near tip, preorbital length 20–26% DW; apical lobe very pronounced and triangular. Eyes rather large, protruding, length of orbit and spiracle ~2 in snout length; interorbital space 1.2–2.3 times orbit length. Mouth narrow, 5 oral papillae; upper jaw moderately undulate with 36–43 tooth rows; labial furrows and folds prominent. Nasal curtain skirt-shaped, broad; margin finely fringed; nostrils oval, oblique. Denticles in a band on central third of disc in adults, flattened heart-shaped or subcircular; juveniles smooth. Mid-shoulder region with 1–2 oval, pearl-like thorns (length 2–4 mm) in both young and adults. Tail narrow-based, length 1.5–2.4 times DW; usually 1 caudal sting; ventral fold long-based and very low. Pelvic fins small, apices narrowly rounded. Pectoral-fin radials 116–127.

COLOUR. Upper surface plain greyish to greenish brown centrally, distinctly paler yellowish or pinkish laterally, without spots or prominent markings; usually with bright yellowish patches below eye and behind spiracle. Ventral surface pale or white, sometimes with faint marginal band; ventral fold dark.

SIZE. Attains at least 28 cm DW (~73 cm TL); males mature at ~21 cm DW.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Mauritania to Congo. Demersal primarily in estuarine and marine habitats, possibly offshore to ~60 m depth. Most likely feeds on small invertebrates.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Closely related to the larger Daisy Whipray (25.19) but the Pearl Whipray has a more narrowly pointed snout, smaller teeth, and a smaller and more oval-shaped pearl thorn.

THORNY WHIPRAY

25.21

Fontitrygon ukpam (Smith, 1863)

EN

IDENTIFICATION. Large freshwater stingray with a subcircular disc, denticles arranged in a broad band (thorny in adults), very long whip-like tail with low ventral fold, and uniform yellowish brown dorsal coloration. Disc thick, usually slightly narrower than long. Snout rather long, obtuse, tip weakly angular. Eyes small, barely protruding, length of orbit and spiracle 1.8–2 in snout length; interorbital space broad, more than 3 times orbit in large specimens. Mouth very narrow, 4–5 oral papillae; labial furrows prominent; upper jaw with 38–46 tooth rows; lower jaw with dense papillae and weakly concave near symphysis. Nasal curtain small, broadly skirt-shaped, fringe weak; nostrils long, slit-like. Upper central disc and tail of large individuals densely covered with a broad band of flat, seed-shaped denticles; denticles interspersed with small thornlets; no distinct mid-shoulder or orbital thorn patches; outer disc largely smooth but condition in large adults unknown. Tail slender, narrow based, length ~2.8 times DW; almost cylindrical in cross-section, tapering gradually to single, short caudal sting; ventral fold short, base about equal to distance between spiracles. Pelvic fins small, narrow, barely extended beyond disc.

COLOUR. Uniformly yellowish brown, darker in preservative. Ventral surface uniformly white.

SIZE. Attains at least 120 cm DW (~330 cm TL); born at ~30 cm DW (~120 cm TL).

HABITAT AND BIOLOGY. West Africa; Gabon, Nigeria and Congo in freshwater. Benthic mostly in lakes and rivers, found more than 240 km upstream from sea (possibly also coastal). Life history and present status of populations in West African rivers unknown. Both type specimens were born after capture of their mother; few other specimens exist in biological collections worldwide.

SIMILAR SPECIES. Previously placed in the genus *Urogymnus* because of its rough disc, but appears to belong to a unique group of West African freshwater and estuarine stingrays (genus *Fontitrygon*). Closely related to marine whiprays of the Indo–Pacific but unlike them, *Fontitrygon* species possess a very narrow ventral fold on the tail.

RED STINGRAY

25.22

Hemitrygon akajei (Müller & Henle, 1841)

NT

IDENTIFICATION. Medium-sized stingray with a broad rhombic disc, small patch of denticles on central disc in adults, thorns sparse or absent, short tail with thin ventral tail fold and low dorsal ridge (no obvious fold), and undersurface with broad yellowish margin. Disc width 1.1–1.2 times its length, trunk rather thick; pectoral-fin apex broadly rounded. Snout broadly triangular, tip pointed, anterior margins straight to weakly concave. Eyes small, length of orbit and spiracle 1.8–2.3 in snout length; interorbital space rather broad, about twice orbit length. Mouth with 3–7 oral papillae; labial furrows and folds prominent; lower jaw with concave symphysis. Nasal curtain skirt-shaped, short and broad, margin weakly fringed; nostrils narrowly oval, oblique. Adults usually with a few small spear-shaped thorns before caudal sting, rarely with minute thorns in median row on disc; thorns absent in young. Skin largely smooth, denticles confined to head in v-shaped patch and on mid-disc of large specimens. Tail length 1.1–1.6 times DW; base depressed slightly; tapering strongly to caudal sting then becoming filamentous, pre-sting length 1.1–1.2 times DW; usually 1 caudal sting; ventral fold variably developed, low (base length 39–58% DW); dorsal ridge low. Pelvic fins extend well beyond disc.

COLOUR. Reddish to greenish brown with yellowish patches below eye and on hind part of spiracle; dark stripe along central tail. Undersurface white with margins vivid yellow; tail sides and undersurface pale, strongly contrasted with dark dorsal surface and black ventral fold; rear part of tail black.

SIZE. Attains ~66 cm DW (~138 cm TL). Males mature at 35–40 cm DW, females 50–55 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; central China to northern Japan. Demersal inshore and on continental shelf to at least 50 m depth. Litters of only 1 pup. Feeds on small bony fishes and crustaceans.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Bennett's Stingray (25.23), once thought to be the same as this species because of its similar yellow ventral disc margin, has a larger head, more elongate disc, and longer tail (length exceeding twice DW rather than less than 1.6 times DW).

BENNETT'S STINGRAY

25.23

Hemitrygon bennetti (Müller & Henle, 1841)

DD

IDENTIFICATION. Medium-sized, plain brownish stingray with a long, weakly rhombic disc, well-defined patch of granular denticles on disc in adults, small thorns in median row along disc and row of enlarged tubercles on tail before caudal sting, and a very long tail with thin ventral tail fold and no dorsal fold or obvious ridge. Disc elongate, length 0.9–1 times width; trunk rather thick; pectoral-fin apex broadly rounded. Snout angular and produced slightly, tip pointed, preorbital length 22–24% DW; anterior margins straight, distinctly shorter than posterior margin. Eyes small, length of orbit and spiracle 2.3–2.4 in snout length; interorbital space rather broad, twice or more orbit length. Mouth with 3–5 oral papillae; labial furrows and folds weak; lower jaw strongly arched. Nasal curtain skirt-shaped, elongate, margin strongly fringed; nostrils narrowly oval, oblique. Adults usually with Y-shaped band of small denticles extending from eyes to hind disc; young smooth or with small patch of denticles on mid-disc. Small thorns in long median row on disc and short row on each shoulder; row of large spear-shaped tubercles on tail before caudal sting; thorns usually absent in young. Tail length 2.3–2.6 times DW; base rather broad, thickened, tapering strongly at sting then becoming whip-like, pre-sting length 1.2–1.3 times DW; 1 or 2 caudal stings; ventral fold long, low (base length 60–67% DW). Pelvic fins extend well beyond disc.

COLOUR. Dark brown to greyish green above, marginally paler on pelvic fins and around disc margin; yellow at front of eye and edge of spiracle. Undersurface of disc white with broad yellowish margin; tail yellowish or white and strongly contrasted with black ventral fold; tail mostly black beyond caudal sting.

SIZE. Attains ~61 cm DW. Males mature at ~32 cm DW; born at ~13–15 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Java to central China, including Taiwan. Biological details confused with other species, probably primarily in coastal habitats on soft bottoms.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Belongs to a group of small Western Pacific stingrays that have been frequently misidentified and information for them is poor. Very similar to the narrow-ranging Oriental Black Stingray (25.29) and its distinctiveness from this species needs to be further investigated.

ESTUARY STINGRAY

25.24

Hemitrygon fluviorum (Ogilby, 1908)

VU

IDENTIFICATION. Medium-sized, plain-coloured stingray with a weakly rhombic disc, short patches of denticles on head and back, well-defined median row of thorns along disc and tail, and a long tail with well-developed dorsal and ventral tail folds. Disc width 1–1.1 times its length, trunk rather thick; pectoral-fin apex broadly rounded. Snout broadly triangular, tip pointed, anterior margins weakly convex. Eyes small, length of orbit and spiracle ~1.7–2.1 in snout length; interorbital space rather broad, 2.8–3.3 times orbit length. Mouth narrow with 5 oral papillae; labial furrows and folds prominent; lower jaw with concave symphysis. Nasal curtain skirt-shaped, short and broad, margin weakly fringed; nostrils moderately elongate. Thorns short, flat-topped and lanceolate anteriorly, in a continuous median row; those near caudal sting often greatly enlarged, spear-shaped. Extensive denticle patches between eyes and on mid-disc but absent from shoulder; rest of disc and tail smooth. Tail broad based, depressed; tapering strongly at sting then becoming whip-like; length 1.8–2.2 times DW; often with 2 caudal stings; ventral fold long, low (base much longer than distance from snout to fifth gill slit); dorsal fold low. Pelvic fins extend slightly beyond disc.

COLOUR. Yellowish, olive brown or greyish above, tail darker. Undersurface of disc white or dusky, without obvious dark margin; tail white anteriorly, greyish or black beyond sting. Skin folds black, darker than adjacent tail.

SIZE. Attains at least 93 cm DW (possibly 160 cm DW). Males mature at ~41 cm DW, females 63 cm DW; born at ~11 cm DW.

HABITAT AND BIOLOGY. Western Central and South-West Pacific; endemic to eastern and northern Australia. Inshore, mainly in mangrove swamps and estuaries. Feeds on shellfish, worms, crabs and other crustaceans.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Most similar to the Merauke Stingray (25.28) but has a more rhomboidal disc with less well-developed median thorns, and a shorter tail.

IZU STINGRAY

25.25

Hemitrygon izuensis (Nishida & Nakaya, 1988)

NT

IDENTIFICATION. Small, plain-coloured stingray with a smooth rhombic disc, tail short and filamentous beyond caudal sting, and well-developed dorsal and ventral tail folds. Disc thick through trunk, width 1.1–1.2 times its length; pectoral-fin apex narrowly rounded to angular in adults. Snout very short and obtuse, small apical lobe, anterior margins straight to weakly convex. Eyes small, length of orbit and spiracle ~1.5 in snout length; interorbital space ~2.5 times orbit length. Mouth rather broad with 5 oral papillae; labial furrows and folds prominent; lower jaw convex. Nasal curtain skirt-shaped, short and broad; margin weakly fringed; nostrils narrowly oval, oblique. Skin smooth, lacking denticles even in adults; rear part of tail smooth. Thorns absent in young, 2–6 thorns on tail of adults. Tail rather broad based, depressed slightly; tapering very strongly at sting then becoming filamentous; length 0.8–1.1 times DW; 1 or 2 caudal stings; ventral fold short, low (base shorter than ventral head length); dorsal fold well developed, low, base length about equal to interorbital width. Pelvic fins of moderate size, tips broadly rounded.

COLOUR. Uniformly pale or dark brown above, often darkest centrally on disc and sometimes finely mottled; tail base similar to disc, becoming black beyond caudal sting; dorsal fold dark. Ventral surface whitish; disc and pelvic-fin margins golden, extending forward to mouth level; ventral fold pale, not strongly contrasted with tail surface.

SIZE. Attains at least 42 cm DW (~66 cm TL); males mature at ~37 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; restricted to southern Japan. Poorly known; occurs inshore where known from depths of 10–20 m, but almost certainly occurs deeper.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Belongs to a small group of Japanese stingrays of the genus *Hemitrygon* with a similar disc shape and appearance that differ subtly in morphology, and which have been shown to differ at a molecular level.

YANTAI STINGRAY

25.26

Hemitrygon laevigata (Chu, 1960)

NT

IDENTIFICATION. Small stingray with a broadly rhombic disc with naked skin, short tail with well-developed dorsal and ventral tail folds, no thorns before caudal sting, and undersurface of disc with greyish yellow margin. Disc short, width 1.1–1.3 times its length, trunk rather thick; pectoral-fin apex narrowly rounded. Snout broadly angular, tip bluntly pointed, anterior margins straight to weakly concave. Eyes small, length of orbit and spiracle ~1.9 in snout length; interorbital space rather broad, more than twice orbit length. Mouth with 1–4 oral papillae; labial furrows and folds prominent; lower jaw with concave symphysis. Nasal curtain skirt-shaped, short and broad, margin weakly fringed; nostrils narrowly oval, oblique. Skin entirely smooth, lacking granular denticles; rarely with up 3 small thorns on mid-disc. Tail base rather broad, depressed, tapering strongly at sting then becoming filamentous; length 1–1.6 times DW; 1 or 2 caudal stings; ventral fold long, slender (base length 35–62% DW); dorsal fold elongate, low. Pelvic fins extend well beyond disc.

COLOUR. Greyish brown above, slightly paler around disc and pelvic-fin margins; pale patches above eye and spiracle. Undersurface of disc white, margins of disc and pelvic fins greyish yellow; anterior half of tail white, not strongly contrasted on side with darker upper surface; ventral fold and end part of tail black.

SIZE. Attains 37 cm DW (~76 cm TL). Males mature at ~24 cm DW, females 29 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Taiwan to southern Japan. Demersal inshore on continental shelf over soft bottoms to depths of ~60 m. Juveniles occur in estuaries and coastal shallows in summer.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Differs from other similar species in the North-West Pacific in having a uniformly smooth dorsal surface or rarely with a few small thorns on central disc (*vs.* variably covered in denticles and thorns).

MEKONG STINGRAY

25.27

Hemitrygon laosensis (Roberts & Karnasuta, 1987)

EN

IDENTIFICATION. Small, plain-coloured stingray with a weakly rhombic to suboval disc, upper surface of disc and tail with median thorns, and tail long and filamentous or whip-like beyond caudal sting with well-developed upper and lower tail folds. Disc thick through trunk, width about equal to its length; pectoral-fin apex broadly rounded. Snout moderately elongate and angular, short lobe at tip, anterior margins almost straight. Eyes small, length of orbit and spiracle about half snout length; interorbital space 2.5–2.8 times orbit length. Mouth rather broad with 5 oral papillae; labial furrows and folds weak; lower jaw strongly convex. Nasal curtain broadly skirt-shaped; margin strongly fringed; nostrils narrowly oval, oblique. Skin smooth in young, in a diffuse patch on central disc and granular denticles on posterior tail in adults. Thorns in more or less continuous median row in adults, those on disc very small and close together, those on tail larger, more widely separated and spear-shaped; pearl and shoulder thorns absent. Tail rather broad based, depressed slightly; tapering strongly at sting then becoming filamentous; length 1.8–2.8 times DW; usually 1 caudal sting; ventral fold long, low (base length similar to ventral head length); dorsal fold well developed, low, about equal to interorbital width. Pelvic fins large, tips broadly rounded.

COLOUR. Uniformly brown above, tail black beyond sting. Ventral surface centrally with smaller white areas on snout and mid-disc and scattered orange blotches in life, rest of disc orange; anterior tail whitish, skin folds black.

SIZE. Attains at least 48 cm DW (~125 cm TL); males mature at ~31 cm DW.

HABITAT AND BIOLOGY. South-East Asia; freshwater, endemic to Mekong River (Cambodia, Thailand). Lives in mainstream and rapids, possibly extending downstream to river delta; introduced to Chao Phraya River (Thailand).

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Occurs in same geographic region as Bennett's Stingray (25.23) and they both have a similar disc shape and orange/yellow ventral markings. Bennett's Stingray seems to have a narrower mouth (8–10% *vs.* 11–13% DW) and more narrowly spaced nostrils (9–10% *vs.* 10–11% DW).

MERAUKE STINGRAY

25.28

Hemitrygon longicauda (Last & White, 2013)

NE

IDENTIFICATION. Small, plain-coloured stingray with a subcircular to weakly rhombic disc, denticle patch developing on central disc with age, continuous row of closely spaced thorns extending along mid-line of disc and tail, small mid-shoulder thorns sometimes present, and long tail with dorsal fold reduced to low ridge or absent. Disc width 1–1.1 times its length, trunk depressed; pectoral-fin apex broadly rounded. Snout broadly triangular, tip extended slightly, anterior margins almost straight. Eyes very small, length of orbit and spiracle 2–2.3 in snout length; interorbital space broad, more than 3 times orbit length. Mouth narrow with 5 oral papillae; labial furrows and folds weak; lower jaw strongly convex. Nasal curtain skirt-shaped, short and broad, margin weakly fringed; nostrils rather oblique. Thorns spear-shaped or lanceolate; in continuous median row, variable in size and becoming larger posteriorly, 3 nearest caudal sting often greatly enlarged. Widely spaced denticles confined to patches between orbits and on central disc of largest individuals. Tail elongate, slender; constricted slightly at sting then becoming whip-like; length 2.3–2.9 times DW; probably 1 sting; ventral fold long, low (base length about equal to distance from snout to fifth gill slit); dorsal fold usually a low ridge or absent. Pelvic fins triangular.

COLOUR. Greyish above, paler along disc margin, thorns white and contrasted with skin; tail darker, blackish beyond caudal sting. Undersurface white, margin not dark. Dorsal skin fold black; ventral fold white anteriorly, becoming black posteriorly (fold sharply demarcated from white ventral area of tail).

SIZE. Attains at least 31 cm DW (98 cm TL), possibly larger as no adults known.

HABITAT AND BIOLOGY. Western Central and South-West Pacific; endemic to southern New Guinea. Little known, but appears to live mainly nearshore in shallow water.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Most similar to the Estuary Stingray (25.24) from Australia, but has a more rounded disc, better-developed row of median thorns, and a longer tail.

ORIENTAL BLACK STINGRAY

25.29

Hemitrygon navarrae (Steindachner, 1892)

DD

IDENTIFICATION. Small, plain chocolate brown stingray with a rhombic disc, well-defined patch of granular denticles on mid-line of disc in adults, greatly enlarged tubercles on tail before caudal sting, and moderately elongate tail with long ventral fold and small dorsal fold. Disc elongate, length ~1.1 in width; trunk thick; pectoral-fin apex rather narrowly rounded. Snout angular and produced slightly, tip pointed, preorbital length ~25% DW; anterior margins almost straight, posterior margin weakly convex. Eyes small, much smaller than spiracle; length of orbit and spiracle 2.1–2.3 in snout length; interorbital space rather broad, ~3 times orbit length. Mouth with 3 oral papillae; labial furrows and folds weak; lower jaw slightly arched. Nasal curtain broadly skirt-shaped, margin fringed; nostrils narrowly oval, oblique. Adult with patch of small, scattered denticles on nape (mid-shoulder denticle sometimes enlarged); denticles continuing in single row to merge with large tubercular thorns on pre-sting tail; tubercles triangular with concave crowns; central disc with minute prickles. Young smooth or with small thorn on mid-disc. Tail rather broad based, depressed, tapering strongly to sting, then becoming slender, filamentous and subcircular in cross-section; length 2.3–2.6 times DW; caudal sting inserted well back on tail, pre-sting length 1.2–1.3 times DW; ventral fold long, low, base length 42–49% DW; length of dorsal fold base 20–23% of ventral fold base. Pelvic fins extend well beyond disc.

COLOUR. Dark above, uniform chocolate brown. Undersurface white, ventral fold black.

SIZE. Attains at least 32 cm DW, a male mature at this size.

HABITAT AND BIOLOGY. North-West Pacific; Shanghai (China) to Cambodia. Poorly known.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Very similar to Bennett's Stingray (25.23) and may prove to be the same species. Known from few specimens in biological collections and more material of both forms (with molecular data) are needed to answer this question.

DWARF BLACK STINGRAY

25.30

Hemitrygon parvonigra (Last & White, 2008)

DD

IDENTIFICATION. Medium-sized, plain-coloured stingray with a rhombic disc, no dermal denticles, thorns small and confined to mid-line of disc and shoulder, long whip-like tail beyond caudal sting, and low dorsal and ventral tail folds. Disc width ~1.2 times its length, trunk thickened slightly; pectoral-fin apex narrowly rounded to angular. Snout broadly triangular, tip extended slightly, anterior margins weakly undulate. Eyes small, length of orbit and spiracle 1.8–1.9 in snout length; interorbital space rather narrow, ~2.2–2.4 times orbit length. Mouth rather narrow with 6 oral papillae; labial furrows and corrugations weak; lower jaw strongly convex. Nasal curtain skirt-shaped, short and broad, margin fringed; nostrils short, oval. Thorns in a short row along mid-line of disc, usually only anteriorly, 1–2 on each shoulder, absent from tail. Denticles absent even in adults. Tail rather broad based, tapering gently to sting then becoming whip-like; length 1.5–1.6 times DW; usually 1 caudal sting; ventral fold long, low (base length about equal to ventral head length); dorsal fold low, base about equal to length of sting. Pelvic fins small.

COLOUR. Yellowish brown to dark greyish brown above, disc margin slightly paler; thorns and tail beyond caudal sting pale. Ventral surface uniformly white.

SIZE. Attains at least 51 cm DW (exceeds 110 cm TL); males mature at ~35 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and Western Central Pacific; Philippines to north-western Australia. Demersal offshore on continental shelf at 60–185 m depths, probably occasionally shallower. Caught incidentally in trawl and net fisheries. Life history unknown.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis* which includes the much larger Brown Stingray (25.3). Despite being in different genera these species are similar in appearance, but the Brown Stingray has large spiny thorns on the tail beyond the caudal sting in adults and adolescents (otherwise absent).

CHINESE STINGRAY

25.31

Hemitrygon sinensis (Steindachner, 1892)

DD

IDENTIFICATION. Small, plain yellowish brown stingray with a rhombic disc lacking thorns, small eyes, weak band of small denticles on disc and before caudal sting, and short tail with long ventral fold and well-developed dorsal fold. Disc elongate, length subequal to width; pectoral-fin apex broadly rounded. Snout narrowly angular and produced slightly, tip bluntly pointed, preorbital length ~25% DW; anterior margins weakly convex and distinctly concave near snout tip. Eyes small, length of orbit and spiracle ~2.5 in snout length; interorbital space broad, 3–3.2 orbit length. Mouth with 5 oral papillae, 3 centrally; labial furrows and folds weak; lower jaw strongly arched. Nasal curtain skirt-shaped, broad and short, margin fringed; nostrils narrowly oval, oblique. Adults with narrow, irregular row of small globular denticles on mid-line of disc and tail before caudal sting; surrounded by slightly wider band of minute granular denticles; no thorns or thornlets on tail. Tail short, length ~1.4 times DW; base rather slender, depressed slightly, tapering gradually to sting then becoming filamentous; ventral fold low (base length ~45% DW); dorsal fold tall, its base length about third of ventral fold base. Pelvic fins extend well beyond disc.

COLOUR. Uniform yellowish brown above, sometimes slightly paler around disc margin; no yellowish markings beside eye and spiracle. Undersurface of disc uniformly white, lacking a distinct yellowish margin.

SIZE. Attains at least 40 cm DW; a male 38 cm DW was mature.

HABITAT AND BIOLOGY. North-West Pacific; China to South Korea, including Yellow Sea. Continental, probably primarily inshore but life history not well documented.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Occurs off China with the more widely distributed Red Stingray (25.22), but differs in having a more narrowly angular snout and lacks the distinctive broad yellowish margin on the undersurface of the disc of the Red Stingray.

AUSTRALIAN WHIPRAY

25.32

Himantura australis Last, White & Naylor, 2016

NE

IDENTIFICATION. Large whipray with a very broad and weakly rhombic disc, nasal curtain skirt-shaped, tail whip-like and without skin folds, and coarse blackish reticulate or speckled colour pattern on upper surface (often finely spotted in young). Disc robust, width 1–1.1 times length; pectoral-fin apex narrowly to broadly rounded; snout broadly triangular, tip pointed; anterior margins straight (rather than concave). Eyes small, protruding, length of orbit and spiracle 1.7–2 in snout length; interorbital space 1.8–2.2 times orbit length. Mouth arched slightly; 4 large papillae, 2 centrally and widely spaced (occasionally with smaller papillae between); labial furrows and folds prominent; lower jaw with weak central concavity. Nasal curtain broad and short, posterior margin finely fringed. Mid-disc usually with 2 small, broadly heart-shaped thorns, but no other enlarged thorns extending along mid-line of disc and tail. Denticle band well developed in adults (edge not evenly and sharply demarcated); tail beyond caudal sting with small prickly denticles Tail narrow-based and subcircular in cross-section, almost hexagonal behind sting; tapering evenly toward sting then becoming whip-like; elongate, length ~3 times DW; usually 1 caudal sting.

COLOUR. Dorsal surface of adults pale yellowish or greyish white, densely covered with darker brown narrow rings, speckles or wavy lines (finest around disc margin); newborns with strong pattern of closely spaced black spots (largest over abdomen); subadults usually with broad blackish reticulate or honeycomb pattern. Upper tail densely dark spotted or reticulate before sting; largely black or marbled posteriorly. Ventral surface white; tail beyond sting usually uniformly black.

SIZE. Attains at least 113 cm DW (~350 cm TL). Males still immature at 82 cm DW; born at ~29 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; northern Australia and New Guinea. Demersal on inner continental shelf to at least 45 m depth. Enters estuaries and brackish water. Litters of up to 4 pups.

SIMILAR SPECIES. Differs subtly from the Coach Whipray (25.34) in colour and body proportions, and the distributional ranges of these species do not appear to overlap.

LEOPARD WHIPRAY

25.33

Himantura leoparda Manjaji-Matsumoto & Last, 2008

VU

IDENTIFICATION. Large whipray with a weakly rhombic disc, broadly pointed snout, nasal curtain skirt-shaped, row of small heart-shaped thorns on mid-shoulder region, well-developed denticle band in adults, tail whip-like and without skin folds, and coarse ocellate or reticulate colour pattern on upper surface (dark spots and blotches in young). Disc robust, slightly longer than wide; pectoral-fin apex narrowly rounded (more angular in young). Snout broadly triangular (more so in young) with small apical lobe; anterior margins straight or weakly concave. Eyes small, protruding, length of orbit and spiracle 1.8–2.2 in snout length; interorbital space 2.5–3.6 times orbit length. Mouth arched; usually 4 papillae, 2 centrally; labial furrows and folds weak; lower jaw with central concavity. Nasal curtain broad and short, posterior margin finely fringed. Central disc usually with 2, broad heart-shaped thorns, preceded by row of up to 13 smaller denticles of similar shape and a row of smaller denticles posteriorly; no other enlarged thorns extending along mid-line of disc and tail. Denticle band well developed in adults, developing relatively slowly in young. Tail narrow-based, suboval in cross-section, tapering evenly toward caudal sting; whip-like beyond sting, tapering more gradually to its tip; elongate, length 2.5–3.7 times DW; usually with 1 caudal sting.

COLOUR. Dorsal surface of adults whitish to yellowish brown with dense pattern of dark medium-sized rings in adults; newborns with large black spots (bigger on mid-disc than near its edge); subadults with spots coalescing and opening to form reticulations and rings; spots and ring-like markings extending over tail before sting, tail banded beyond sting. Ventral surface almost entirely white.

SIZE. Attains at least 140 cm DW (410 cm TL). Males mature at 70–80 cm DW; born at ~20 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; widespread from South Africa to eastern Australia, northward to Japanese Archipelago. Demersal inshore on continental and insular shelves, on soft substrates to at least 70 m depth.

SIMILAR SPECIES. Similar to the Honeycomb Whipray (25.35), but has smaller dark rings and reticulations on the dorsal surface of adults, and its mid-shoulder denticles are heart-shaped (rather than pearl-shaped).

COACH WHIPRAY

25.34

Himantura uarnak (Gmelin, 1789)

VU

IDENTIFICATION. Large whipray with a broad rhombic disc, nasal curtain skirt-shaped, tail whip-like and without skin folds, and with finely reticulate or spotted colour pattern on upper surface in adults (finely spotted or densely reticulate in young). Disc robust, width 1–1.1 times length; pectoral-fin apex weakly angular to narrowly rounded. Snout broadly triangular, tip pointed; anterior margins concave. Eyes small, protruding, length of orbit and spiracle 2.1–2.2 in snout length; interorbital space 1.8–3.4 times orbit length. Mouth arched slightly; 4 large oral papillae, 2 centrally widely spaced (occasionally with smaller papillae between); labial furrows and folds prominent; lower jaw with weak central concavity. Nasal curtain broad and short, posterior margin finely fringed. Central disc with 1–3 small heart-shaped thorns, but no other enlarged thorns extending along mid-line of disc and tail. Denticle band well developed in adults, extending onto tail; tail beyond caudal sting with small sharp thorns. Tail narrow-based, subcircular in cross-section, tapering evenly toward sting; becoming whip-like, tapering more gradually behind sting to tail tip; elongate, length ~3–3.5 times DW; usually 1 caudal sting.

COLOUR. Dorsal surface of large adults pale yellowish, white or greyish, densely covered with very small brownish black spots and flecks (finest around disc margin); newborns with prominent pattern of similar-sized, closely spaced black spots; forming dense reticulate pattern in subadults; tail densely dark spotted above before sting, weakly banded posteriorly. Ventral surface almost entirely white.

SIZE. Attains 160 cm DW (~450 cm TL). Males mature at ~82 cm DW; birth size 21–28 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; widespread, South Africa to Indonesia and Philippines, including Borneo. Demersal on sandy and muddy bottoms on continental and insular shelves to at least 50 m depth. Enters freshwater. Litters of 2 pups observed.

SIMILAR SPECIES. Belongs to a small group of large densely spotted, ocellated, or reticulated whiprays. Forms provisionally identified as the Coach Whipray may comprise a still unresolved complex of species. A recently described whipray *Himantura tutul* appears to be a synonym.

HONEYCOMB WHIPRAY

25.35

Himantura undulata (Bleeker, 1852)

VU

IDENTIFICATION. Large whipray with a suboval disc, narrowly pointed snout, nasal curtain skirt-shaped, large pearl thorn(s) on central disc, well-developed denticle band, tail whip-like and without skin folds, and with a very coarse reticulate colour pattern on upper surface in adults (large dark spots and blotches in young). Disc robust, width subequal to length; pectoral-fin apex broadly rounded; snout triangular, small pointed lobe at tip; anterior margins straight to convex before tip. Eyes small, protruding, length of orbit and spiracle 2.7–3 in snout length; interorbital space 2.7–3.1 times orbit length. Mouth arched, usually 4 oral papillae (2 centrally); labial furrows and folds weak; lower jaw with prominent central concavity. Nasal curtain broad and short, posterior margin finely fringed. Central disc with large pearl thorn (yellowish), followed by 2–3 slightly smaller similar thorns in adults (first of these usually white); no other enlarged thorns extending along mid-line of disc and tail. Denticle band well developed in adults, extending onto tail. Tail narrow-based, suboval in cross-section, tapering evenly toward caudal sting; becoming whip-like, tapering more gradually beyond sting; elongate, length ~3 times DW; usually with 1 caudal sting.

COLOUR. Dorsal surface of large adults with dense pattern of large dark, thick-lined rings and reticulations; young with large dusky spots and blotches that coalesce to form reticulations during growth; disc coloration extending over tail before sting, tail weakly banded beyond sting. Ventral surface almost entirely white.

SIZE. Attains at least 130 cm DW (~400 cm TL). Males mature at 60–70 cm DW; birth size ~26–27 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; India to Java (Indonesia) and Borneo. Demersal inshore on soft substrates on continental and insular shelves. Life history not well known; probably feeds mainly on crustaceans and small fishes.

SIMILAR SPECIES. Similar to the Leopard Whipray (25.33), but has larger dark rings and reticulations on the dorsal surface and thorns of the mid-disc are pearl-shaped (rather than heart-shaped).

SOUTHERN STINGRAY

25.36

Hypanus americanus (Hildebrand & Schroeder, 1928)

DD

IDENTIFICATION. Large, plain-coloured stingray with a rather broad rhombic disc, row of thornlets on each shoulder and continuous median row of small thornlets in adults, whip-like tail lacking bucklers and enlarged thorns, well-developed ventral tail fold, and low dorsal fold on tail after caudal sting. Disc width ~1.2 times its length, trunk thick; pectoral-fin apex abruptly rounded to angular. Snout rather short, obtuse, tip barely extended, anterior margins straight to weakly concave. Eyes large, length of orbit and spiracle more than half snout length; interorbital space narrow, slightly exceeding orbit length. Mouth with 3 central oral papillae, often with smaller papillae laterally; labial furrows deep; lower jaw weakly convex. Nasal curtain broadly skirt-shaped, margin strongly fringed; nostril profile irregular, weakly oblique. Skin naked in young, with small denticles in patches on interorbit and along mid-disc in adults; adults with row of small, ridge-like thornlets along mid-disc and anterior tail, and short row on each shoulder; tail beyond sting covered with small prickly denticles. Tail long, tapering evenly, length ~2.5 times DW; 1 or more caudal stings; ventral fold long, depth about equal to tail height just beyond sting, dorsal fold flexible, sometimes reduced to a fleshy ridge. Pelvic fins rather small, apices abruptly rounded.

COLOUR. Uniform greyish, brownish or greenish above. Ventral surface white; margin of disc usually dusky or brownish.

SIZE. Attains ~150 cm DW, usually much smaller. Males mature at ~51 cm DW, females 75–80 cm DW; born at 17–19 cm DW (20–34 cm DW in captivity).

HABITAT AND BIOLOGY. Western Atlantic; eastern USA (including Gulf of Mexico) to Brazil. Coastal marine and estuarine habitats to 55 m depths; lives on sand flats, or near seagrasses and coral reefs. Litters of 2–7 pups; gestation period of 5–8 months in captivity. Feeds mainly on crustaceans.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Resembles the larger Roughtail Stingray (25.2) but differs in having a fleshy dorsal ridge on the tail (*vs.* absent) and tail beyond the caudal sting in adults lacks sharp thorns (*vs.* very spiny).

DIAMOND STINGRAY

25.37

Hypanus dipterurus (Jordan & Gilbert, 1880)

DD

IDENTIFICATION. Large stingray with a weakly rhombic to broadly oval disc, short tail, skin largely smooth with rows of small thornlets on body mid-line and shoulders, dorsal and ventral tail folds both short-based and tall, and upper surface uniformly dark. Disc width 1.1 times its length, trunk thick; pectoral-fin apex broadly rounded to abruptly angular. Snout short, obtuse, tip not extended, anterior margins weakly convex. Eyes medium-sized, length of orbit and spiracle ~1.5 in snout length; interorbital space rather broad, ~2.5 times orbit length. Mouth broad with 5 oral papillae; labial furrows deep; lower jaw weakly convex with concavity at symphysis. Nasal curtain skirt-shaped, margin weakly fringed; nostrils slit-like, oblique. Skin of young entirely smooth; adults with median thorn row from nape to caudal sting, and on shoulders. Tail broad based and depressed at base, length 1.2–1.6 times DW (tail often not intact); tapering rapidly to caudal sting then filamentous; usually 1 caudal sting; ventral fold base length about equal to third of precloacal length; dorsal fold taller than adjacent tail, ending near posterior part of ventral fold. Pelvic fins rather large, broadly triangular, apices rounded.

COLOUR. Uniform dark olive brown to blackish above on disc, lacking diagonal row of white pores. Ventral surface white. Tail pale before sting, posterior portion dark in young; skin folds usually black.

SIZE. Possibly attains 100 cm DW. Males mature at 43–46 cm DW, females 57–66 cm DW; born at 18–23 cm DW.

HABITAT AND BIOLOGY. Eastern Central Pacific; southern California (USA) to northern Peru, and Hawaii. Primarily tropical and subtropical on continental and insular shelves to ~150 m depth. Lives mainly in shallow inshore waters over sand and mud bottoms, or near rocky reefs and kelp beds. Litters of 1–4 pups; gestation period of ~3 months. Feeds on marine worms, crabs and clams.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. The relationship between populations off western America and Hawaii needs further investigation. Often confused with the Longtail Stingray (25.39) but among other things, differs in having a much shorter tail.

LONGNOSE STINGRAY

25.38

Hypanus guttatus (Bloch & Schneider, 1801)

DD

IDENTIFICATION. Very large, plain brownish or olive stingray with a rhombic disc, angular snout, band of heart-shaped denticles over central disc in large individuals, row of thorns along mid-line of disc and tail (those at base of tail often greatly enlarged), and tail long and whip-like with weak dorsal ridge and long low ventral fold. Disc moderately robust through trunk, width ~1.1 times length; pectoral-fin apex abruptly rounded, more angular in adults. Snout moderately elongate, tip bluntly pointed, anterior margins undulate. Eyes small, length of orbit and spiracle ~2.5–2.9 in snout length; interorbital space ~2.5 times orbit length. Mouth narrow with 3 oral papillae; labial furrows and folds prominent; lower jaw with concave symphysis. Nasal curtain skirt-shaped, narrow, margin weakly fringed; nostrils slit-like. Denticle band broadest on central disc; denticles most prominent and densest in large individuals, rather widely spaced. Thorns on central disc and tail largest, spear-shaped; 1–2 shoulder thorns often lost in adults. Tail narrow-based, rounded in cross-section; tapering gradually to caudal sting then becoming whip-like; length 2.5–3 times DW; usually 1 caudal sting; ventral fold more slender than adjacent tail (base ~1.5 times distance from cloaca to sting origin). Pelvic fins small, narrowly rounded.

COLOUR. Uniformly brownish or olive green above, sometimes with darker spots; dorsal ridge and ventral fold black. Ventral surface white to yellowish on disc, rear of tail darker.

SIZE. Attains at least 180 cm DW (possibly to 200 cm DW); born at ~15 cm DW.

HABITAT AND BIOLOGY. Western Central Atlantic; Mexico (Gulf of Mexico) to southern Brazil. Demersal on continental shelf to depths of at least 35 m, but likely to be deeper; occurs in brackish water, with young collected from tide pools. Feeds on echinoderms, worms, molluscs, crustaceans and small fishes.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Occurs together with the Southern (25.36) and Roughtail Stingrays (25.2), but differs from them in having a more prominent snout tip and a better-defined denticle band in large juveniles and adults.

LONGTAIL STINGRAY

25.39

Hypanus longus (Garman, 1880)

DD

IDENTIFICATION. Large, plain-coloured stingray with a broad rhombic and largely smooth upper disc, long whip-like tail lacking bucklers and enlarged thorns, long ventral tail fold, and low longitudinal ridge on upper tail beyond caudal sting. Disc width ~1.2 times its length, trunk not thick; pectoral-fin apex abruptly angular. Snout rather long, bluntly angular, tip not extended, anterior margins almost straight. Eyes large, length of orbit and spiracle 1.4–1.8 in snout length; interorbital space narrow, 1.5–2 times orbit length. Mouth with 5 oral papillae; labial furrows deep; lower jaw weakly convex. Nasal curtain skirt-shaped, margin strongly fringed; nostril profile slit-like, weakly oblique. Skin naked in young; very narrow band of small sparse denticles extending from interorbit along mid-disc in adolescents (adults unknown but likely to be similar based on related species). Largest individuals with minute thorns on shoulder, short row on nape, and up to 4 slightly larger spear-shaped thorns on tail before sting. Tail slender, tapering gently, length 2–2.2 times DW; usually 1 narrow caudal sting; ventral fold depth slightly less than tail height just beyond sting, dorsal fold reduced to low ridge. Pelvic fins rather small, apices broadly rounded.

COLOUR. Uniform greyish to reddish brown above with paler patches before eyes and behind spiracles. Ventral surface white with broad reddish brown margin around disc and pelvic fins; tail white anteriorly, posterior part and skin fold darker.

SIZE. Attains ~158 cm DW. Males mature at ~82 cm DW, females ~110 cm DW; born at ~40 cm DW.

HABITAT AND BIOLOGY. Eastern Central Pacific; Baja California (Mexico) to Ecuador, including Galapagos Islands. Demersal on continental shelf to at least 90 m depth; lives on sand bottoms and nearby rocky reefs. Litters of 1–5 pups; gestation period 10–11 months. Feeds mainly on mantis shrimps and fishes.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Closely resembles the Southern Stingray (25.36) from the Western Atlantic, but differs in having fewer thorns on the disc and occurs in deeper water.

LARGE-EYE STINGRAY

25.40

Hypanus marianae (Gomes, Rosa & Gadig, 2000)

DD

IDENTIFICATION. Small stingray with a weak rhombic disc, large eye, weak median row of small thorns in adults, shoulder thorn sometimes present, tail short and lacking bucklers and thorns, ventral and dorsal tail folds short based and deep, and upper surface yellow with bluish disc margin. Disc long, less than width in adults, pectoral-fin apex narrowly rounded. Snout short, angular, anterior margins slightly convex. Eyes large, protruding, orbit and spiracle length slightly shorter than snout length; interorbital space very narrow, subequal to orbit length. Mouth with 3 central oral papillae; labial furrows deep; lower jaw weakly convex with concave symphysis. Nasal curtain skirt-shaped; nostrils narrowly oval, not oblique. Skin without denticles; adults with row of 2–18 small median thorns on disc and single thorn on each shoulder of males. Tail moderately broad based, tapering evenly, length less than twice DW, filamentous beyond caudal sting and often damaged; usually 1 caudal sting; ventral fold depth equal to or exceeding tail height near sting tip; dorsal fold deep, more than half depth of ventral fold and ending at same level. Pelvic fins rather small, apices narrowly rounded.

COLOUR. Disc yellowish brown above with darker blotches between spiracles and on mid-shoulder and precaudal regions; disc and pelvic-fin margins blue. Ventral surface of disc white, with 2 symmetrical pairs of dark markings in adults.

SIZE. Attains at least 31 cm DW, possibly to 40 cm DW.

HABITAT AND BIOLOGY. Western Atlantic; endemic to Brazil (Maranhão to southern Bahia). Inshore, associated mainly with seagrasses; juveniles occur in estuaries and off sandy beaches. Litters small, possibly restricted to single pup. Feeds mainly on shrimps, crabs and lobsters. Retained for human consumption and also part of aquarium trade.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Most similar in shape to the Southern Stingray (25.36), but is smaller with larger eyes, a shorter tail, and with better-developed tail folds.

SMALLTOOTH STINGRAY

25.41

Hypanus rudis (Günther, 1870)

DD

IDENTIFICATION. Very large, plain-coloured stingray with a broad angular rhombic disc, thornlets developing on shoulder and in continuous median row on body before caudal sting, tail long and whip-like lacking bucklers and enlarged thorns, and well-developed ventral tail fold and no flexible dorsal fold (reduced to ridge or absent). Disc width 1.1–1.2 times its length, trunk thick; pectoral-fin apex abruptly rounded to angular. Snout short, obtuse, tip barely extended, anterior margins almost straight. Eyes large, length of orbit and spiracle ~3 in snout length; interorbital space rather broad, ~2.5 times orbit length. Mouth with 3 central oral papillae, often a smaller papilla near each corner; labial furrows deep; lower jaw weakly convex. Nasal curtain broadly skirt-shaped, margin strongly fringed; nostril profile oblique. Skin naked in young, rough with small denticles more widespread in adults. Row of small, ridge-like thornlets extend along mid-disc and on anterior tail in large specimens; shoulder row similar to interorbit in length. Tail long, tapering evenly, ~1.7 times DW; usually 1 caudal sting; ventral fold long, equal to slightly taller than tail height just beyond sting; dorsal fold reduced to low inflexible ridge (triangular in cross-section) in young, indistinct in adults. Pelvic fins rather small, apices abruptly rounded.

COLOUR. Uniform yellowish to greyish brownish, sometimes whitish below eyes; thornlets white. Ventral surface of disc white, broad outer margin often dusky; tail white to caudal sting, then dark beyond.

SIZE. Attains ~198 cm DW (~330 cm TL), possibly exceeding 200 kg; birth size unknown but probably large, late-term embryos 33–39 cm DW.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Nigeria (Old Calabar River), possibly to Sierra Leone. Probably coastal marine and estuarine, reported from 30 m depth. Litters of ~4 pups. Not well known and more data needed.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Resembles the Southern Stingray (25.36) from the Western Atlantic in body shape and denticle pattern, but differs in having a firm dorsal ridge on the tail at all stages of growth (rather than a flexible, fleshy dorsal fold).

ATLANTIC STINGRAY

25.42

Hypanus sabinus (Lesueur, 1824)

LC

IDENTIFICATION. Small, plain-coloured stingray with a weakly rhombic disc, long and pointed snout, shoulder thorns and median row of small sparsely distributed thorns in adults, a short filamentous tail with few thorns and no bucklers, and well-developed dorsal and ventral tail folds. Disc width subequal to its length, trunk thin; pectoral-fin apex broadly rounded. Snout angular, tip extended and narrowly rounded, anterior margins strongly concave. Eyes rather large, length of orbit and spiracle 1.9–2.6 in snout length; interorbital space broad, 1.3–2.3 times orbit length. Mouth with 3 stout oral papillae; labial furrows shallow; lower jaw convex. Nasal curtain distinctly bilobed, margin fringed; nostrils slit-like, oblique. Skin naked in young with small denticle patches developing on interorbit and central disc in adults; row of small thorns extending along mid-disc and anterior tail, and 1–2 on each shoulder in adults; very small denticles near tail tip; undersurface smooth. Tail tapering evenly, ~1.7–1.8 times DW; 1 or 2 rather slender caudal stings; ventral fold long, depth slightly larger than tail height just beyond sting, dorsal fold low but prominent. Pelvic fins well developed, apices narrowly rounded.

COLOUR. Uniform brownish to yellowish brown above, paler toward disc margin and often with darker median stripe on back; dorsal fold yellowish. Ventral surface white or with dark margin; tail pale with darker tip and contrasting brownish skin fold.

SIZE. Attains at least 45 cm DW. Males mature at 20–25 cm DW, females 20–25 cm DW; born at 10–13 cm DW.

HABITAT AND BIOLOGY. North-West Atlantic; Delaware (USA) to Mexico (Gulf of Mexico). Coastal marine, estuarine and freshwater; benthic on sandy bottoms to a depth of 25 m. Litters of 2–3 pups; gestation 4 months. Feeds mainly on crustaceans and marine worms.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. In the Western Atlantic, similar to the Bluntnose Stingray (25.43), but differs in having the snout longer than the distance between the spiracles (*vs.* shorter) and the distance from the cloaca to caudal sting exceeding 45% DW (*vs.* <40% DW).

BLUNTNOSE STINGRAY

25.43

Hypanus say (Lesueur, 1817)

LC

IDENTIFICATION. Medium-sized, plain stingray with a weak rhombic disc, short and obtuse snout, small shoulder thorns and median row of small sparsely distributed thorns in adults, short filamentous tail without prominent thorns or bucklers, and well-developed dorsal and ventral tail folds. Disc slightly wider than long, trunk rather thin; pectoral-fin apex broadly rounded. Snout bluntly angular, tip not extended, anterior margins straight to weakly convex. Eyes medium-sized, length of orbit and spiracle 1.4–1.9 in snout length; interorbital space broad in adults, up to 4.5 times orbit length. Mouth with 5 oral papillae; labial furrows shallow; lower jaw convex. Nasal curtain skirt-shaped, margin fringed; nostrils oval, oblique. Skin entirely naked in young and mostly naked on disc of adults; very small thorns in a single row along mid-disc and anterior tail form a narrow nuchal band in adults; short row or band on each shoulder; undersurface smooth. Tail tapering evenly, 1.3–1.7 times DW; 1 or 2 slender caudal stings; ventral fold short, deeper than tail height just beyond sting; dorsal fold very prominent, almost as deep as adjacent tail. Pelvic fins well developed, apices narrowly rounded.

COLOUR. Variable, plain brownish, reddish or greenish above; paler in young and sometimes with bluish markings; both skin folds and posterior tail dusky or black. Ventral surface of disc white, margin often dark-edged; sides of tail between folds white.

SIZE. Attains at least 78 cm DW. Males mature at 30–36 cm DW, females 50–54 cm DW; born at 15–17 cm DW.

HABITAT AND BIOLOGY. Western Atlantic; central Brazil to Connecticut (USA). Coastal marine and estuarine in shallow water. Litters of 2–4 pups; gestation 10–11 months, including a period of embryonic diapause. Feeds mainly on marine worms, bivalves, crustaceans and small fishes.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis*. Resembles the Atlantic Stingray (25.42), but differs in having a shorter and more rounded snout, and the caudal sting positioned more anteriorly on the tail.

BARAKA'S WHIPRAY

25.44

Maculabatis ambigua Last, Bogorodsky & Alpermann, 2016

NE

IDENTIFICATION. Medium-sized whipray with a weak rhombic disc, moderately large head (41–44% DW), internasal width 7.1–7.9% DW, nasal curtain skirt-shaped, largest mid-shoulder thorn oval to pearl-like, well-developed denticle band in adults, tail whip-like without skin folds, unspotted greyish pink or brownish coloration, and tail banded in young. Disc rather thick through trunk, slightly wider than long, length usually ~92–94% DW; pectoral-fin apex narrowly rounded. Snout broad and rather short with small triangular apical lobe; anterior margins almost straight. Eyes small, protruding slightly, length of orbit and spiracle 1.9–2.2 in snout length; interorbital space ~2 times orbit length. Mouth small; 2 prominent central oral papillae, sometimes with much smaller lateral papillae; labial furrows and folds prominent; lower jaw arched slightly, concave near symphysis. Nasal curtain posterior margin barely fringed. Mid-shoulder denticles up to 5, 1 usually much larger and longer than wide; denticle band subrectangular, very well developed, extending well forward and laterally to eyes in adults, truncate near tail base; rest of disc smooth; no thorn-like denticles on disc or tail. Tail long and slender, length 2.3–2.5 times DW; almost circular in cross-section anteriorly, distinctly depressed beyond sting; usually with 1 caudal sting; upper surface (and often most of undersurface) entirely covered with denticles. Pelvic fins small.

COLOUR. Dorsal surface of disc and tail uniformly greyish or brownish in adults, sometimes dark around disc margin in young; alternating light and dark bands confined to tail upper surface in juveniles, black bands broadest. Ventral surface of disc and pre-sting tail white; tail uniformly greyish beyond sting (not banded).

SIZE. Attains at least 90 cm DW (~290 cm TL).

HABITAT AND BIOLOGY. Western Indian Ocean; Red Sea to Tanzania (Zanzibar). Biology unknown.

SIMILAR SPECIES. Resembles another plain-coloured whipray from the Western Indian Ocean, the Arabian Banded Whipray (25.51), but differs subtly in coloration, disc ratios, and shape of the mid-shoulder denticles.

PAKISTAN WHIPRAY

25.45

Maculabatis arabica Manjaji-Matsumoto & Last, 2016

NE

IDENTIFICATION. Medium-sized, plain-coloured whipray with a rhombic disc, large head (43–47% DW) and internasal width 8.4–9.6% DW, nasal curtain skirt-shaped, mid-shoulder denticles heart- or seed-shaped, broad denticle band in adults, posterior tail rather thick and whip-like without skin folds, and tail partly banded in young. Disc rather broad through trunk, mid-shoulder region raised; slightly wider than long, length 88–94% DW; pectoral-fin apex narrowly rounded. Snout broad and rather short; triangular apical lobe distinct; anterior margins weakly concave. Eyes small, protruding slightly, length of orbit and spiracle 1.9–2.3 in snout length; interorbital space ~2.3 times orbit length. Mouth small, 2–4 oral papillae (medial pair enlarged, lateral pair minute); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain posterior margin finely fringed. Mid-shoulder denticles 1–3, small, preceded by row of up to 10 smaller enlarged denticles; denticle band wide in adults, subrectangular, broader than interspiracular distance for most of its length; rest of disc smooth; no enlarged thorny denticles on mid-line of tail before sting. Tail long and slender, length 2.2–2.6 times DW; narrow-based, slightly depressed in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting; usually 1 caudal sting; tail beyond caudal sting sparsely covered with denticles. Pelvic fins broad.

COLOUR. Dorsal surface uniformly pale brown to greenish brown, paler along disc margin and denticle band. Tail with alternating narrow pale bands and broader dark bands on upper half of tail behind sting in young (uniformly pale ventrally); uniformly pale brownish in adults. Ventral surface white, disc margin often dusky.

SIZE. Attains at least 61 cm DW (>200 cm TL).

HABITAT AND BIOLOGY. Northern Indian Ocean; Arabian Sea (off Pakistan and western India). Presumably benthic on muddy bottoms. Probably feeds mainly on small invertebrates.

SIMILAR SPECIES. The Arabian Banded Whipray (25.51) attains a similar size (~62 cm DW), but has a much narrower internasal space.

BLACKSPOTTED WHIPRAY

25.46

Maculabatis astra (Last, Manjaji-Matsumoto & Pogonoski, 2008)

LC

IDENTIFICATION. Medium-sized whipray with a rhombic disc, nasal curtain skirt-shaped, mid-shoulder region raised with 1–3 small seed- or narrow heart-shaped denticles, denticles small and dense within well-developed band, tail whip-like without folds, variably covered above with small black spots and specks (surrounded by white spots), and tail banded in young. Disc with thin trunk, width 1.1–1.2 times length; pectoral-fin apex angular to narrowly rounded. Snout rather short, broadly triangular, tip pointed with weak lobe; anterior margins almost straight. Eyes small, protruding slightly, length of orbit and spiracle 1.5–1.8 in snout length; interorbital space 1.6–2.6 times orbit length. Mouth arched, 4 oral papillae (2 centrally); labial furrows and folds prominent; lower jaw with a central concavity. Nasal curtain short, posterior margin double concave, finely fringed. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 2.1–2.7 times DW; 1–3 caudal stings; tail beyond caudal sting sparsely covered with denticles.

COLOUR. Dorsal surface greyish brown with dense pattern of black spots; black spots small, diffuse-edged, usually surrounded by slightly smaller whitish spots or rings. Tail with alternating light and dark saddles or bands beyond caudal sting in young, saddled above and pale ventrally in large adults. Ventral surface of disc uniformly white.

SIZE. Attains at least 80 cm DW (180 cm TL); both sexes mature at ~50 cm DW; birth size 17–21 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; off Australia and southern New Guinea. Demersal inshore, over muddy bottoms or mangrove flats to 140 m depth. Litters of 1–3 pups. Feeds mainly on prawns and crabs.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Very similar to the Brown Whipray (25.52) which is almost plain or often has fine whitish spots and flecks in adults (rather than black spots). However, these forms cannot be separated using molecular data and more work is needed to confirm they are distinct.

SHORTTAIL WHIPRAY

25.47

Maculabatis bineeshi Manjaji-Matsumoto & Last, 2016

NE

IDENTIFICATION. Small, plain-coloured whipray with a rhombic disc, large head (44–49% DW) and internasal width 8.8–9.4% DW, nasal curtain skirt-shaped, largest mid-shoulder denticle heart-shaped, broad denticle band in adults, and tail whip-like without skin folds and partly banded in young. Disc rather broad through trunk; slightly wider than long, length 93–99% DW; pectoral-fin apex narrowly rounded. Snout broad and moderately elongate; distinct triangular apical lobe; anterior margins almost straight. Eyes small, protruding slightly, length of orbit and spiracle 1.9–2.7 in snout length; interorbital space 1.7–2.6 times orbit length. Mouth small, 4 oral papillae (medial pair enlarged, lateral pair small); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain posterior margin finely fringed. Mid-shoulder denticles 1–3 (1 large and pearl-like), not preceded by distinct row of smaller denticles; denticle band wide in adults (much wider than interspiracular space), denticles very densely packed on mid-disc; rest of disc smooth; no enlarged thorny denticles on mid-line of tail. Tail slender, elongate, length 2.3–2.6 times DW; narrow-based, slightly depressed in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting; usually 1 caudal sting; tail beyond caudal sting sparsely covered with denticles. Pelvic fins rather broad.

COLOUR. Dorsal surface uniform pale brown; pre-sting tail with white spots along dorsolateral surface. Tail dark with weak dorsal banding behind sting. Ventral surface white, with broad yellowish margins on disc and pelvic fins.

SIZE. Attains at least 42 cm DW; born at 15–17 cm DW.

HABITAT AND BIOLOGY. Northern Indian Ocean; Arabian Sea (Pakistan) and Bay of Bengal (Odisha, India). Presumably benthic on muddy bottoms. Probably feeds mainly on small invertebrates.

SIMILAR SPECIES. The Pakistan Whipray (25.45) probably attains a similar size, but has a slower rate of development of denticles on the disc. The secondary denticle band in the Shorttail Whipray is well developed by 24 cm DW (*vs.* well developed at a much larger size).

WHITESPOTTED WHIPRAY

25.48

Maculabatis gerrardi (Gray, 1851)

VU

IDENTIFICATION. Large whipray with a rhombic disc, large head (41–45% DW), internasal width 6.4–7.7% DW, enlarged oval mid-shoulder denticle, obvious denticle band in adults, tail whip-like without skin folds, and upper surface plain or white spotted. Disc rather flat, slightly wider than long, length ~89–93% DW; pectoral-fin apex rounded to somewhat angular. Snout broad, with an enlarged triangular apical lobe, anterior margins weakly concave. Eyes small, protruding slightly, length of orbit and spiracle 1.3–2.1 in snout length; interorbital space 1.3–2.7 times orbit length. Mouth arched, 2–5 oral papillae (medial pair enlarged); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain subrectangular, posterior margin finely fringed. Mid-shoulder denticle large, much larger than smaller denticles adjacent; denticle band well developed in adults and developing early in young. Tail long and slender, length 2.4–2.9 times DW; slightly depressed in cross-section, tapering gently and evenly toward caudal sting, then weakly beyond sting; usually 1 caudal sting; tail beyond caudal sting sparsely covered with denticles.

COLOUR. Dorsal surface dark olive green to paler greenish grey, usually with numerous white spots (may be dark-edged) or with spots confined to posterior disc; often paler on outer margin of disc; tail with lateral row of white spots forward of caudal sting and banded behind sting in young (faintly banded in adults). Ventral surface white.

SIZE. Attains ~116 cm DW (~350 cm TL). Males mature at 48–58 cm DW, females 63 cm DW; born at 13–21 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; Oman to Indonesia, and north to Taiwan. Mainly benthic on soft bottoms from inshore to depths of at least 60 m. Litters of 2–4 pups. Feeds mainly on small prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Once confused with the Sharpnose Whipray (25.49) from the Indo–Malay Archipelago, which has a smaller head (less than 41% DW) and broader internasal width (exceeding 8.3% DW).

SHARPNOSE WHIPRAY

25.49

Maculabatis macrura (Bleeker, 1852)

NE

IDENTIFICATION. Medium-sized whipray with a rhombic disc, small head (39–41% DW), internasal width 8.3–8.8% DW, small oval to heart-shaped mid-shoulder denticle, obvious denticle band in adults, tail whip-like without skin folds, and upper surface variably white-spotted. Disc rather flat, wider than long, length 76–87% DW; pectoral-fin apex rounded to somewhat angular. Snout broad, with an enlarged triangular apical lobe, anterior margins weakly concave. Eyes small, protruding slightly, length of orbit and spiracle ~2 in snout length; interorbital space 1.9–2 times orbit length. Mouth arched, 2–5 oral papillae (medial pair enlarged); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain subrectangular, posterior margin finely fringed. Mid-shoulder denticle small, only slightly larger than smaller denticles adjacent; denticle band well developed in adults with slow development in young. Tail very long and slender, length 2.8–3.4 times DW; slightly depressed in cross-section, tapering gently and evenly toward caudal sting, then weakly beyond sting; usually 1 caudal sting; tail beyond caudal sting sparsely covered with denticles.

COLOUR. Dorsal surface usually medium greenish grey with numerous white spots (may be dark-edged), usually denser on posterior disc; usually paler brownish pink on outer margin of disc; tail with prominent lateral row of white spots forward of caudal sting and banded behind sting in young (feebly banded in adults). Ventral surface white.

SIZE. Attains ~85 cm DW (~220 cm TL), possibly larger. Males mature at ~46–48 cm DW, females ~64 cm DW; born at ~18 cm DW.

HABITAT AND BIOLOGY. Western Pacific; Indo–Malay Archipelago, Nusa Tenggara (Indonesia) to Taiwan. Mainly benthic on soft bottoms from inshore to depths of at least 60 m. Feeds mainly on small prawns.

SIMILAR SPECIES. Until recently, has been confused with the more widely distributed Whitespotted Whipray (25.48), but differs in having a relatively smaller head, shorter disc and broader internasal distance than that species.

ROUND WHIPRAY

25.50

Maculabatis pastinacoides (Bleeker, 1852)

VU

IDENTIFICATION. Medium-sized, plain coloured whipray with a broadly suboval disc, nasal curtain skirt-shaped, denticle band very broad in adults, usually 1–2 large pearl-like thorns on mid-disc, and tail whip-like without skin folds and not banded. Disc as wide as long; rather broad through trunk, raised slightly on shoulder; pectoral-fin apex broadly rounded. Snout rather short, broadly triangular; apical lobe short; anterior margins weakly convex. Eyes large, length of orbit and spiracle 2.2–2.5 in preorbital length; interorbital distance 1.7–4.1 times orbit length, widest in adults. Mouth small, 2–4 oral papillae (medial pair enlarged, lateral 2 small); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain posterior margin finely fringed. Denticle band very broad, well defined and developing rapidly with growth (fully developed by 30 cm DW); edge sharply demarcated, rounded anteriorly and wider than twice interorbital space over entire disc in adults. Thorns confined to mid-disc; pearl-like when present, anteriormost thorn enlarged. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 2.2–3 times DW; usually 1 caudal sting situated anteriorly on tail; tail beyond caudal sting densely granular. Pelvic fins triangular.

COLOUR. Dorsal surface uniform brownish, greyish to greenish; tail blackish behind sting. Ventral surface entirely white, sometimes with narrow dusky margins.

SIZE. Attains ~86 cm DW (~186 cm TL). Males mature at 43–46 cm DW, females ~58 cm DW; birth size 15–16 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Sumatra, Java and Borneo. Benthic, inshore in coastal embayments, estuaries and near large river mouths. Probably feeds mainly on small fishes and prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Closely resembles the Shorttail Whipray (25.47) from the Northern Indian Ocean, but differs in having much less densely packed denticles in the mid-disc band.

ARABIAN BANDED WHIPRAY

25.51

Maculabatis randalli (Last, Manjaji-Matsumoto & Moore, 2012)

NE

IDENTIFICATION. Medium-sized whipray with a weak rhombic disc, large head (44–47% DW), internasal width 7.9–8.1% DW, nasal curtain skirt-shaped, largest mid-shoulder denticle heart-shaped, well-developed denticle band in adults, tail whip-like without skin folds, upper surface greenish grey and unspotted, and tail banded in young. Disc rather broad through trunk, slightly wider than long, length ~93–98% DW; pectoral-fin apex narrowly rounded. Snout broad and moderately elongate; apical lobe triangular and slightly enlarged; anterior margins weakly concave to almost straight. Eyes small, protruding slightly, length of orbit and spiracle 2.1–2.4 in snout length; interorbital space 2.3–3.2 times orbit length. Mouth narrow, arched, 2 oral papillae (situated close together); labial furrows and folds prominent; lower jaw arched slightly, concave near symphysis. Nasal curtain posterior margin finely fringed. Mid-shoulder denticles 1–2, small, oval to heart-shaped; denticle band suboval, well developed, tapering near tail base; rest of disc smooth; no thorn-like denticles on disc or tail. Tail long and slender, length 1.8–2.4 times DW; slightly depressed in cross-section, tapering gently and evenly toward caudal sting, then weakly beyond sting; usually 1 caudal sting; entirely covered with denticles. Pelvic fins broad.

COLOUR. Dorsal surface uniformly greenish grey, with a broad pale outer margin; tail dark, sharply demarcated from paler ventral half in adults, with white saddles in young. Ventral surface white.

SIZE. Attains at least 62 cm DW (~185 cm TL). Males mature at ~40 cm DW; born at 15–17 cm DW.

HABITAT AND BIOLOGY. Northern Indian Ocean; possibly endemic to Persian Gulf. Lives mainly on soft sandy and muddy bottoms to at least 60 m depth. Feeds mainly on small shrimps.

SIMILAR SPECIES. Previously placed in the genus *Himantura.* Similar to the more widespread Sharpnose Whipray (25.49) which usually has white spots, and a shorter disc, longer tail, shorter head and narrower internasal space. Presently unrecognised plain-coloured *Maculabatis* may occur in the Indian Ocean.

BROWN WHIPRAY

25.52

Maculabatis toshi (Whitley, 1939)

LC

IDENTIFICATION. Medium-sized whipray with a broad rhombic disc, nasal curtain skirt-shaped, short row of small heart-shaped denticles on mid-disc, main denticle band not wider than interspiracular width, tail whip-like without skin folds, upper surface uniform brownish or with dark spotting (often sparse), and tail banded in young. Disc rather broad and flat, width 1–1.2 times length; pectoral-fin apex moderately angular. Snout moderately long, tip pointed, anterior margins weakly concave. Eyes rather large, length of orbit and spiracle 1.7–2.2 in snout length; interorbital space rather broad and flat. Mouth arched, 4 oral papillae (central pair simple); labial furrows and folds prominent; lower jaw with concave symphysis. Nasal curtain short and broad, margin weakly fringed; nostrils narrow, laterally expanded. Mid-shoulder denticles small; main denticle band well developed in adults; no enlarged thorn-like denticles on disc or tail. Tail narrow-based, subcircular in cross-section; tapering very gently and evenly toward caudal sting, with weak taper beyond sting, then becoming whip-like; denticles on anterior tail small, flat, much sparser towards tail tip; length 2.5–3 times DW; 1 or 2 caudal stings. Pelvic fins subtriangular, short.

COLOUR. Dorsal surface brown (or greenish brown), often with dark spots near disc edge in young and becoming white-spotted as adults; tail dark, banded beyond sting in young. Ventral surface white, margin sometimes dusky.

SIZE. Attains ~82 cm DW (~170 cm TL). Males mature at ~50 cm DW; born at ~14 cm DW.

HABITAT AND BIOLOGY. Western Central and South-West Pacific; northern and eastern Australia, and southern Papua New Guinea. Mainly soft muddy bottoms and on mangrove flats. Feeds mainly on small fishes, crabs and prawns.

SIMILAR SPECIES. The very similar Blackspotted Whipray (25.46) has small black spots surrounded with clusters of white spots on the upper disc. Juveniles of the Brown Whipray are plain (sometimes with a few black spots at rear of disc), whereas adults are typically covered with small white spots.

CHINDWIN COWTAIL RAY

25.53

Makararaja chindwinensis Roberts, 2007

DD

IDENTIFICATION. Small freshwater stingray with a subcircular disc, long filamentous tail with moderately well-developed ventral fold, skin granular on dorsal surface but not forming distinct denticle band on central disc, thorns rudimentary or absent, and uniformly dusky above. Disc slightly longer than wide, apices broadly rounded. Snout moderately elongate, broadly angular, tip pointed. Eyes small, length of orbit and spiracle ~1.7 in snout length; interorbital space about twice orbit length. Mouth small, 4 short oral papillae; no obvious labial papillae or furrows; jaws arched, bulbous and interlocking. Nasal curtain flared with v-shaped posterior margin; nostrils short, slit-like. Denticles minute, dense, velvety on disc and tail; 5 small thorns on nuchal region, thorns absent elsewhere. Tail long, length ~1.5 times DW; base rather broad and depressed, tapering gently, not noticeably constricted near sting or compressed beyond sting; 2 caudal stings, longest very elongate and slender; ventral fold narrow, height behind sting much less than adjacent tail height, base length ~70% DW; dorsal fold absent. Pelvic fins large, tips narrowly rounded.

COLOUR. Dorsal surface pale greyish or brown; tail dark on all surfaces, type specimen blotched in preservative. Undersurface of disc white; ventral fold paler than adjacent tail.

SIZE. Attains at least 39 cm DW, but reputed to reach ~50 cm DW.

HABITAT AND BIOLOGY. Known from 1 specimen (Chindwin River, Myanmar); reported to be reasonably common by local fishers but more material needed. Probably confined to freshwater, but life history unknown and may also enter estuaries.

SIMILAR SPECIES. Related to members of the genus *Pastinachus* but it has a more rounded disc, weaker coverage of denticles (lacks a distinct denticle band on the disc) and median thorns, and the ventral fold is relatively slender (rather than being deep and fleshy).

SMALLEYE STINGRAY

25.54

Megatrygon microps (Annandale, 1908)

DD

IDENTIFICATION. Huge, plain-coloured stingray with a thick, very angular rhombic disc, skin rough but lacking enlarged thorns or bucklers, broad-based tail becoming filamentous at base of caudal sting, sting positioned well back on tail, and rows of white spots on upper disc. Disc very broad, width 1.4–1.5 times its length; apex abruptly angular to narrowly rounded. Snout short, bluntly rounded, tip not extended, anterior margins almost straight. Eyes small, length of orbit and spiracle ~3 in snout length in adults; interorbital space variable, 1.5–4 times orbit length. Mouth usually with 5 oral papillae; labial furrows shallow; lower jaw almost straight. Nasal curtain very broadly skirt-shaped, margin weakly fringed; nostrils short and narrow. Skin densely covered with minute, stellate denticles; largest on snout tip and near eyes; tail base and sides covered with slightly larger thorn-like denticles; thorns beyond sting densest, mostly small. Tail short, very broad and depressed to sting; its length subequal to disc width; usually 1 caudal sting; ventral fold very low, dorsal fold reduced, keel-like. Pelvic fins large, extending well beyond disc, apices angular.

COLOUR. Brownish or pinkish above with diagonal row of white spots on each pectoral fin base; tail greyish dorsally, blackish beyond caudal sting. Ventral surface white; margins of disc and undersurface of tail before sting often dusky.

SIZE. Attains at least 222 cm DW (exceeding 300 cm TL); born at ~33 cm DW.

HABITAT AND BIOLOGY. Indo–Pacific; Mozambique to eastern Australia. Benthopelagic (and possibly pelagic) over continental and insular shelves in tropical seas; not caught commonly anywhere across its range. Litters of a single pup. One of few stingrays swimming actively in open water rather than resting for periods on bottom.

SIMILAR SPECIES. Possibly not a true stingray (family Dasyatidae) based on molecular evidence. Appears more closely related to round rays (Urotrygonidae) and neotropical stingrays (Potamotrygonidae). More research is needed to determine its true placement. Its body shape is distinctive among all rays having a caudal sting.

PLAIN MASKRAY

25.55

Neotrygon annotata (Last, 1987)

NT

IDENTIFICATION. Small stingray with a largely smooth broadly rhombic disc, small thorns confined to central disc and sometimes on tail before caudal sting, tail rather short with dorsal and ventral folds, no blue spots on body, posterior tail banded, and a dark mask-like marking around eyes. Disc rather broad, width 1.1–1.3 times its length, trunk thin; pectoral-fin apex narrowly rounded. Snout rather short, usually angular, tip barely extended, anterior margins distinctly concave. Eyes medium-sized, protruding slightly, length of orbit and spiracle 2.1–2.4 in snout length; interorbital space 1.5 times or more orbit length. Mouth with 2 long oral papillae; labial furrows and folds prominent; lower jaw weakly convex. Nasal curtain skirt-shaped, elongate and narrow; v-shaped margin fringed; nostrils narrow, curved. Skin lacking denticles; 4–13 small, seed-shaped thorns along mid-line of disc, 0–4 on anterior tail before caudal sting; no prickly denticles on tail beyond sting. Tail firm, broad based and depressed anteriorly, slender beyond sting; usually only slightly longer than DW; usually 2 caudal stings; ventral fold low, elongate, base about equal to distance from snout to 3rd to 5th gill slit; dorsal fold short based, similar in height to ventral fold. Pelvic fins large, apices rather pointed.

COLOUR. Uniform brownish to greyish green above, usually lacking small black spots; mask-like markings moderately well developed, pair dark blotches on mid-disc. Ventral surface dusky or white. Tail bands often faint, ventral fold usually dusky.

SIZE. Attains ~28 cm DW (at least 45 cm TL); both sexes mature at 18–21 cm DW; born at 12–14 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; northern Australia, southern New Guinea and eastern Indonesia. Demersal, often well offshore, on continental shelf at 10–60 m depths. Litters of 1–3 pups. Feeds on small bony fishes and crustaceans.

SIMILAR SPECIES. Differs from other maskrays (genus *Neotrygon*) within the region where it occurs by its relatively plain colour pattern and more angular snout.

AUSTRALIAN BLUESPOTTED MASKRAY

25.56

Neotrygon australiae Last, White & Séret, 2016

NE

IDENTIFICATION. Small stingray with a smooth rhombic disc, thorn row confined to median disc, broadly angular snout, rather short tail with both dorsal and ventral folds, pattern of large bluish spots on upper disc (usually present on medial strip on disc), posterior half of tail banded, and a mask-like marking around eyes. Disc rather broad, width 1.2–1.3 times its length, trunk fleshy; pectoral-fin apex abruptly angular in adults. Snout short, broadly rounded to bluntly angular, tip not extended, anterior margins straight to weakly convex. Eyes large, protruding, length of orbit and spiracle 0.8–1.2 in snout length; interorbital space subequal to orbit length. Mouth small, with 2 broad oral papillae; labial furrows and folds prominent; jaws asymmetric. Nasal curtain skirt-shaped, rather narrow; margin undulate, heavily fringed; nostrils narrow. Skin lacking fine denticles; row of small thorns extending variably along mid-line of disc between nape and back above cloaca; no prickly denticles on tail beyond sting. Tail firm (not long and whip-like), rather broad based and depressed anteriorly, slender and compressed beyond sting; length up to 1.5 times DW; 1 or 2 caudal stings; ventral fold low, elongate, base length 4–6.6 times dorsal fold base length; dorsal fold much lower than ventral fold. Pelvic fins large, apices narrowly rounded.

COLOUR. Upper surface pale yellowish brown with large blue spots; spots usually ocellate (bluish white with thick darker grey-blue ring); spots well represented on medial strip; mask-like marking distinct; dark speckles concentrated on mask, comparatively sparse elsewhere. Undersurface white with greyish submarginal band. Tail with black and white bands near tip; dorsal and ventral folds blackish.

SIZE. Attains ~38 cm DW (at least 61 cm TL). Males mature at ~28 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean; Australia, New Guinea and eastern Indonesia. Demersal, from inshore to mid-continental and insular shelves at 25–90 m depths. Biology little known.

SIMILAR SPECIES. Dorsal disc slightly more heavily spotted, but otherwise very similar to other bluespotted maskrays of the region.

BLUESPOTTED MASKRAY

25.57

Neotrygon caeruleopunctata Last, White & Séret, 2016

NE

IDENTIFICATION. Small stingray with a smooth rhombic disc, thorn row confined to median disc, obtuse snout, rather short tail with dorsal and ventral folds, smallish bluish spots on upper disc (usually absent or sparse on medial strip on disc), posterior tail banded, and mask-like marking around eyes. Disc rather broad, width 1.2–1.3 times its length, trunk fleshy; pectoral-fin apex abruptly angular. Snout short, broadly rounded, tip not extended, anterior margins straight to weakly convex. Eyes large, protruding, length of orbit and spiracle 1.1–1.5 in snout length; interorbital space subequal to orbit length. Mouth small, with 2 broad oral papillae; labial furrows and folds prominent; jaws asymmetric. Nasal curtain skirt-shaped, rather narrow; margin undulate, heavily fringed; nostrils narrow. Skin lacking fine denticles; row of small thorns extending variably along mid-line of disc between nape and back above cloaca (best developed in adults); no prickly denticles on tail beyond sting. Tail firm (not long and whip-like), rather broad based and depressed anteriorly, slender and compressed beyond sting; length up to 1.5 times DW; 1 or 2 caudal stings; ventral fold low, elongate, base length 5.2–6.1 times dorsal fold base length; dorsal fold slightly lower than ventral fold. Pelvic fins large, apices narrowly rounded.

COLOUR. Upper surface pale greenish brown with small to medium-sized blue ocelli (pale blue with darker blue outer ring); spots less dense on medial strip than pectoral fins; mask-like weak with few speckles. Undersurface white with sharply defined dark submarginal band. Tail usually dark ventrally; banded near tip; skin folds almost entirely dark.

SIZE. Attains ~47 cm DW (at least 70 cm TL). Male was mature at 31 cm DW; born at ~17 cm DW.

HABITAT AND BIOLOGY. Indian Ocean; southern Indonesia, possibly westward to Africa. Demersal, inshore to mid-continental and insular shelves. Biology little known.

SIMILAR SPECIES. Western distribution is presently unresolved. Differs subtly from the Oriental Bluespotted Maskray (25.61) in its larger size, and a somewhat shorter ventral fold and darker ventral tail.

KUHL'S MASKRAY

25.58

Neotrygon kuhlii (Müller & Henle, 1841)

DD

IDENTIFICATION. Small stingray with a smooth rhombic disc, thorn row confined to nape, broadly angular snout, rather short tail with both dorsal and ventral folds, weak pattern of very small bluish spots on upper disc (sometimes present on medial strip on disc), posterior half of tail banded, and pronounced mask-like marking around eyes. Disc rather broad, width ~1.2 times its length, trunk fleshy; pectoral-fin apex narrowly rounded. Snout short, broadly angular, tip not extended, anterior margins straight to weakly convex. Eyes large, protruding, length of orbit and spiracle 1.1–1.2 in snout length; interorbital space subequal to orbit length. Mouth small, with 2 broad oral papillae; labial furrows and folds prominent; jaws asymmetric. Nasal curtain skirt-shaped, rather narrow; margin undulate, heavily fringed; nostrils narrow. Skin lacking fine denticles; row of thorns not extending onto back or tail; no prickly denticles on tail beyond sting. Tail firm (not long and whip-like), rather broad based and depressed anteriorly, slender and compressed beyond sting; length ~1.2–1.4 times DW; probably 1 or 2 caudal stings; ventral fold low, elongate, base length ~6.9 times dorsal fold base length; dorsal fold about half height of ventral fold. Pelvic fins large, apices narrowly rounded.

COLOUR. Upper surface of disc greenish brownish, paler toward margins; bluish spots and ocelli widely spaced and very small (less than half length of cornea); mask-like markings usually prominent. Ventral surface white, sometimes with darker pectoral and pelvic-fin margins. Tail almost uniformly greyish or greyish blue with black and white bands at tip.

SIZE. Attains ~30 cm DW (at least 62 cm TL).

HABITAT AND BIOLOGY. South-West Pacific; Solomon Islands. Demersal, from inshore to mid-insular shelves. Data poor due to confusion with other related species.

SIMILAR SPECIES. Probably restricted to Oceania. Once confused with other blue-spotted maskrays, its small size and relative paucity of blue spots make it distinctive in the South Pacific.

PAINTED MASKRAY

25.59

Neotrygon leylandi (Last, 1987)

LC

IDENTIFICATION. Small stingray with a largely smooth rhombic disc, small thorns usually confined to central disc, short tail with both dorsal and ventral folds, mosaic colour pattern on upper surface (without blue spots nor densely black-spotted), posterior tail mottled and banded, and a dark mask-like marking around eyes. Disc variably broad, width 1.1–1.3 times its length, trunk thin; pectoral-fin apex narrowly rounded to angular. Snout short, bluntly angular to rounded, tip not extended, anterior margins weakly undulate. Eyes large, protruding, length of orbit and spiracle 1.9–2.3 in snout length; interorbital space subequal to orbit length. Mouth with 2 long oral papillae; labial furrows and folds prominent; lower jaw strongly convex. Nasal curtain skirt-shaped, rather narrow; v-shaped margin fringed; nostrils narrow, curved. Skin lacking denticles; 1–9 small, seed-shaped thorns along mid-line of disc, rarely on anterior tail before caudal sting; no prickly denticles on tail beyond sting. Tail firm, broad based and depressed anteriorly, slender beyond sting; length up to 1.4 times longer than DW; usually 2 caudal stings; ventral fold low, elongate, base longer than distance from snout to 5th gill slit; dorsal fold short based, similar in height to ventral fold. Pelvic fins large, apices rather pointed.

COLOUR. Uniform pale brownish to yellowish above, covered with elaborate network of darker reticulations and flecks; mask-like markings well defined, blotches on mid-disc usually faint. Ventral surface of disc white, often with sharply demarcated yellowish brown margins. Tail bands strong, ventral fold pale with dark margin.

SIZE. Attains ~27 cm DW (at least 53 cm TL); born at ~11 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia. Demersal, mainly on inner continental shelf at 15–90 m depths; also offshore to 200 m. Litters of 1–3 pups. Feeds mainly on small crustaceans.

SIMILAR SPECIES. Very similar to the more heavily spotted Speckled Maskray (25.62) from north-eastern Australia.

NINGALOO MASKRAY

25.60

Neotrygon ningalooensis Last, White & Puckridge, 2010

DD

IDENTIFICATION. Small stingray with a smooth weakly rhombic disc, thorn row confined to central disc, short tail with both dorsal and ventral folds, scattering of small, orange spots and larger bluish white blotches on disc, tail end banded, and mask-like marking around eyes weakly speckled. Disc not especially broad, width ~1.1 times its length, trunk fleshy; pectoral-fin apex broadly rounded. Snout short, bluntly angular to rounded, tip not extended, anterior margins weakly undulate. Eyes large, protruding greatly, length of orbit and spiracle ~1.4 in snout length; interorbital space slightly wider than orbit length. Mouth small, with 2 very long oral papillae; labial furrows and folds prominent; jaws asymmetrical. Nasal curtain skirt-shaped, rather narrow; margin undulate, fringed; nostrils narrow. Skin lacking denticles; usually 4–5 small thorns along mid-line of disc and none on anterior tail before caudal sting; no prickly denticles on tail beyond sting. Tail firm, rather broad based and depressed anteriorly, slender beyond sting; length ~1.1 times longer than DW; 2 caudal stings; ventral fold low, elongate, base longer than distance from snout to 5th gill slit; dorsal fold short based, lower than ventral fold. Pelvic fins large, apices rather pointed.

COLOUR. Pale yellowish brown above, becoming richer brownish near disc margin; densely covered with small orange flecks and spots and slightly larger bluish white ocelli; mask-like markings often faint. Ventral disc white, usually with broad brownish margins. Tail banded at tip, ventral fold of tail speckled.

SIZE. Attains at least 30 cm DW; maturity and birth sizes unknown.

HABITAT AND BIOLOGY. Eastern Indian Ocean and Western Central Pacific; off western and northern Australia. Demersal, primarily in shallow water near coast (usually shallower than 5 m depth). May have specialised habitat requirements.

SIMILAR SPECIES. The very rich, orange speckled coloration is unique within the genus and presumably helps camouflage this ray on pinkish sands where it occurs.

ORIENTAL BLUESPOTTED MASKRAY

25.61

Neotrygon orientalis Last, White & Séret, 2016

NE

IDENTIFICATION. Small stingray with a smooth rhombic disc, thorn row confined to median disc, obtuse snout, rather short tail with dorsal and ventral folds, medium-sized bluish spots on upper disc (usually absent or sparse on medial strip on disc), posterior tail banded, and prominent mask-like marking around eyes. Disc rather broad, width 1.2–1.3 times its length, trunk fleshy; pectoral-fin apex broadly rounded. Snout short, broadly rounded, tip not extended, anterior margins straight to convex. Eyes large, protruding, length of orbit and spiracle 1–1.3 in snout length; interorbital space usually narrow than orbit length. Mouth small, with 2 broad oral papillae; labial furrows and folds prominent; jaws asymmetric. Nasal curtain skirt-shaped, rather narrow; margin undulate, lightly fringed; nostrils narrow. Minute denticles on mid-disc in largest adults; small thorns in row on mid-line of disc (not well-developed posteriorly); no prickly denticles on tail beyond sting. Tail firm (not long and whip-like), rather broad based and depressed anteriorly, slender and compressed beyond sting; length up to 1.5 times DW; 1 or 2 caudal stings; ventral fold low, elongate, base length 6.6–7.5 times dorsal fold base length; dorsal fold less than half height of ventral fold. Pelvic fins large, apices narrowly triangular.

COLOUR. Upper surface pale yellowish brown with medium-sized blue spots and weak ocelli (pale blue with slightly darker blue outer ring); spots less dense on medial strip of disc than pectoral fins; mask-like marking pronounced with dense coverage of dark speckles. Undersurface white with faint submarginal band. Tail usually pale ventrally; banded near tip; ventral skin fold dusky, edge darker.

SIZE. Attains ~38 cm DW (at least 73 cm TL). Males mature at ~24 cm DW; born at ~12 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Indonesia, Borneo, Philippines and Taiwan. Demersal, inshore to mid-continental and insular shelves.

SIMILAR SPECIES. Differs from the Bluespotted Maskray (25.57) in its smaller size, and having a relatively longer ventral fold and ventral tail that is usually pale before the caudal sting.

SPECKLED MASKRAY

25.62

Neotrygon picta Last & White, 2008

LC

IDENTIFICATION. Small stingray with a largely smooth rhombic disc, small thorns (when present) usually confined to central disc, short tail with both dorsal and ventral folds, heavily speckled coloration on upper surface (without blue spots), posterior tail mottled, and speckled mask-like marking around eyes. Disc width ~1.2 times its length, trunk thin; apex narrowly rounded to abruptly angular. Snout short, bluntly angular to rounded, tip not extended, anterior margins weakly undulate. Eyes medium-sized, protruding greatly, length of orbit and spiracle ~2 in snout length; interorbital space slightly wider than orbit length. Mouth with 2 long oral papillae; labial furrows and folds prominent; lower jaw strongly convex. Nasal curtain skirt-shaped, rather narrow; v-shaped margin fringed; nostrils narrow, curved. Skin lacking denticles; 0–10 small thorns along mid-line of disc (rare on tail); no prickly denticles on tail beyond sting. Tail firm, broad based and depressed anteriorly, slender beyond caudal sting; length up to 1.3 times longer than DW; usually 2 caudal stings; ventral fold low, elongate, base longer than distance from snout to 5th gill slit; dorsal fold short based, similar in height to ventral fold. Pelvic fins large, apices rather pointed.

COLOUR. Uniform pale brownish or yellowish above; speckled with small dark spots and often with coarse reticulate pattern; mask-like markings formed by clusters of fine dark spots. Ventral disc usually white; sometimes with faint yellowish or brownish margins. Tail banded, ventral fold speckled.

SIZE. Attains 32 cm DW (at least 60 cm TL); both sexes mature at ~17–18 cm DW.

HABITAT AND BIOLOGY. Western Central and South-West Pacific; northern Australia and southern Papua New Guinea. Demersal on inner continental shelf, offshore to 100 m depth (usually shallower than 25 m). Litters of 1–3 pups. Feeds mainly on small crustaceans.

SIMILAR SPECIES. Very similar in body shape to the Painted Maskray (25.59) from off Western Australia, but differs in having a relatively wider interspiracular distance, mouth and nasal curtain, and denser speckling.

CORAL SEA MASKRAY 25.63

Neotrygon trigonoides (Castelnau, 1873)

NE

IDENTIFICATION. Small stingray with a smooth rhombic disc (usually lacking thorns on nape), short tail with both dorsal and ventral folds, small blue-edged white ocelli and black speckles on upper disc, prominent mask-like marking around eyes, and sides of tail mottled and tip banded. Disc broad, width ~1.3 times its length, trunk fleshy; pectoral-fin apex abruptly angular. Snout short, bluntly angular, tip not extended, anterior margins almost straight to weakly undulate. Eyes large, protruding, length of orbit and spiracle ~1.4 in snout length; interorbital space subequal to orbit length. Mouth very small, with 2 broad central oral papillae; labial furrows and folds prominent; jaws asymmetric. Nasal curtain skirt-shaped, rather narrow; margin concave, strongly fringed; nostrils narrow. Skin usually lacking denticles and thorns. Tail firm, broad based and depressed slightly anteriorly, tapering gradually to caudal sting; slender, almost rounded below sting, flattened posteriorly (not long and whip-like); length slightly longer than DW; usually 1 caudal sting; ventral fold low, elongate, base ~1.5 times distance from snout to 5th gill slit; dorsal fold short based, lower than ventral fold. Pelvic fins large, apices rather pointed.

COLOUR. Upper surface yellowish to brownish, variably covered with small ocelli (half pupil length or less) and black speckling; mask-like markings and blotches on nape prominent and very strongly speckled. Ventral disc white with broad dark margins (sharply defined). Tail brownish, skin folds dark brown; 1–2 wide white bands near tail tip.

SIZE. Attains at least 35 cm DW (~70 cm TL).

HABITAT AND BIOLOGY. South-West Pacific; Coral Sea off eastern Australia and New Caledonia. Demersal inshore on sandy bottoms, often associated with coral reefs.

SIMILAR SPECIES. Part of species complex that includes the Australian Bluespotted Maskray (25.56). The Coral Sea Maskray typically has smaller bluish markings and a more speckled disc than populations of the Australian Bluespotted Maskray with which it partly overlaps in distribution.

MAHOGANY MASKRAY

25.64

Neotrygon varidens (Garman, 1885)

NE

IDENTIFICATION. Small stingray with a smooth rhombic disc, small median thorns, short tail with dorsal and ventral folds, mask-like marking around eyes, upper surface usually plain (lacking large blue spots), and posterior half of tail weakly banded. Disc rather broad, width ~1.2 times its length, trunk fleshy; pectoral-fin apex abruptly angular in adults. Snout short, bluntly angular to rounded, tip not extended; anterior margins straight to weakly undulate. Eyes large, protruding, length of orbit and spiracle 1.4–1.7 in snout length; interorbital space broader than orbit length in adults. Mouth small, with 2 oral papillae; labial furrows and folds prominent; jaws asymmetric. Nasal curtain skirt-shaped, rather long and narrow; posterior margin concave, heavily fringed; nostrils elongate. Skin lacking dermal denticles; row of small, narrow median thorns on nape (closely spaced), sometimes also on trunk. Tail firm, depressed anteriorly, tapering to caudal sting and then slender and compressed (not whip-like); length 1.1–1.2 times DW; usually 1 caudal sting; ventral fold well developed (similar height to adjacent tail), very elongate, base 1.6–1.8 times distance from snout to 5th gill slit; dorsal fold tall and short based. Pelvic fins large, apices bluntly pointed.

COLOUR. Upper surface of disc usually plain brown to reddish brown (margin often paler); sometimes with few, very small bluish spots (rarely more than 3); mask-like markings prominent but usually no dense speckling nor blotches on nape. Ventral disc white, sometimes with dark margins. Tail brownish or dusky anteriorly; sides white beneath sting, with 2–3 white bands near tip; skin folds dark brown.

SIZE. Attains ~33 cm DW (at least 60 cm TL); males mature at ~28 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Thailand to Taiwan, including Borneo (Sarawak and Kalimantan). Demersal on continental and insular shelves. Biology not well known.

SIMILAR SPECIES. North-West Pacific populations of the closely related Australian Bluespotted Maskray (25.56) have large blue spots on the upper disc (rather than being typically plain).

BROAD COWTAIL RAY

25.65

Pastinachus ater (Macleay, 1883)

LC

IDENTIFICATION. Very large stingray with a very broad rhombic disc, flat denticles forming wide band on central disc in adults, small heart-shaped or starry-based thorns on mid-shoulder, long tail lacking thorns but with well-developed ventral tail fold followed by a filament, and uniformly greyish or black above. Disc width 1.2–1.3 times its length; anterior margins straight, apices angular; trunk thick. Snout short, obtuse, with small lobe at tip. Eyes small, length of orbit and spiracle 1.7–2.3 in snout length; interorbital space broad, exceeding 3.5 times orbit length. Mouth small, not greatly protrusible, 5 oral papillae; jaws arched, bulbous and interlocking. Nasal curtain skirt-shaped, bilobed; nostrils slit-like, oblique. Denticle band distinct, becoming less dense toward outer pectoral fin; snout extremity naked. Usually 4 small thorns on shoulder, often barely larger than surrounding denticles. Tail about twice DW or less; base very broad and strongly depressed, tapering gently and not noticeably constricted near caudal sting; usually 1 caudal sting positioned well back on tail; ventral fold very deep, height behind sting 3.6–5.7 times adjacent tail height, base 74–92% DW; dorsal fold absent. Pelvic fins large, tips narrowly rounded.

COLOUR. Uniform dark greyish brown to black above; tail fold and tail tip black. Undersurface white, often with fine black edge around disc and pelvic fins, ventral tail with black areas before sting.

SIZE. Attains ~200 cm DW (exceeding 300 cm TL); born at ~18 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific, widespread; Madagascar to New Caledonia. Demersal on continental and insular shelves. Mainly marine but ventures into estuaries and freshwater. Litters of 2 pups. Marketed in South-East Asia for meat, skin and cartilage.

SIMILAR SPECIES. Similar to and often confused with the Cowtail Ray (25.67), which is the more common of the two species where they co-occur in the Western Indian Ocean. These species differ subtly in morphology, denticle structure and distribution, and at a molecular level.

NARROW COWTAIL RAY

25.66

Pastinachus gracilicaudus Last & Manjaji-Matsumoto, 2010

NE

IDENTIFICATION. Medium-sized stingray with a broad rhombic disc, flat denticles forming wide band on central disc in adults, pearl-like thorns on mid-shoulder, long tail lacking thorns but with well-developed ventral tail fold followed by a filament, and uniformly greyish brown above. Disc width 1.1–1.2 times its length; anterior margins broadly convex, apices angular; trunk thick. Snout rather short, obtuse, with small lobe at tip. Eyes small, length of orbit and spiracle 2.1–2.4 in snout length; interorbital space broad, exceeding 4 times orbit length. Mouth small, not greatly protrusible, 5 oral papillae; jaws arched, bulbous and interlocking. Nasal curtain rather broad and short, weakly bilobed; nostrils slit-like, oblique. Denticle band distinct, snout apex naked. Two enlarged pearl thorns on shoulder, usually preceded by smaller irregular-shaped thorn. Tail 1.8–2.6 times DW; base rather broad and depressed, tapering gently and not noticeably constricted near caudal sting; usually 1 caudal sting positioned well back on tail; ventral fold rather deep, height behind sting 2.8–3.6 times adjacent tail height, base 74–103% DW; dorsal fold absent. Pelvic fins large, tips narrowly rounded.

COLOUR. Dorsal surface plain greyish brown; tail usually dark on all surfaces. Undersurface of disc white or with narrow blackish margin; ventral fold pale to bluish with dark edge.

SIZE. Attains 83 cm DW; males mature at ~67 cm DW; born at 19–26 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; eastern India, Java (Indonesia) and Borneo. Demersal inshore on continental insular shelves. Little known of its biology.

SIMILAR SPECIES. Co-occurs with the much larger Broad Cowtail Ray (25.65), but differs in having more prominent pearl-like shoulder thorns and a more slender ventral fold. Populations off India and Indonesia/Borneo differ slightly at a molecular level and need further investigation.

COWTAIL RAY

25.67

Pastinachus sephen (Forsskål, 1775)

DD

IDENTIFICATION. Medium-sized stingray with a very broad rhombic disc, starry-based denticles forming wide band on central disc in adults, small seed-shaped thorns on mid-shoulder in young (usually absent in adults), long thornless tail with well-developed ventral tail fold and terminal filament, and uniformly greyish or black above. Disc width 1.2–1.3 times its length; anterior margins almost straight, apices angular; trunk thick. Snout short, obtuse, with minute lobe at tip. Eyes small, length of orbit and spiracle 1.6–1.8 in snout length; interorbital space broad, exceeding 3 times orbit length. Mouth small, not greatly protrusible, 5 oral papillae (central 3 closely adjacent); jaws arched, bulbous and interlocking. Nasal curtain diverging posteriorly, bilobed; nostrils slit-like, oblique. Denticle band distinct, becoming less dense toward outer pectoral fin; snout extremity naked. Usually 2 small thorns on shoulder in young; thorns usually merging with denticle band in adults. Tail usually less than twice DW; base broad and depressed, tapering gently and not noticeably constricted near caudal sting; usually 1 caudal sting positioned well back on tail; ventral fold very deep, height behind sting 3.5–4.8 times adjacent tail height, base 77–98% DW; no dorsal fold. Pelvic fins large, tips narrowly rounded.

COLOUR. Dorsal surface plain yellowish brown to greyish, orbit and spiracle blackish; tail usually dark on all surfaces apart from white ventral base. Undersurface of disc white, often with narrow black margins; ventral fold bluish or black.

SIZE. Attains at least 89 cm DW, but sizes need reassessing due to confusion with other cowtail stingrays.

HABITAT AND BIOLOGY. Northern Indian Ocean; Red Sea to Pakistan. Demersal, mainly inshore on soft bottoms, often near coral reefs. Feeds on small fishes, molluscs, crustaceans and marine worms.

SIMILAR SPECIES. Often confused with the Broad Cowtail Ray (25.65) with which it overlaps in the Northern Indian Ocean. The two species differ subtly in morphology, denticle pattern, and at a molecular level.

ROUGHNOSE COWTAIL RAY

25.68

Pastinachus solocirostris Last, Manjaji & Yearsley, 2005

EN

IDENTIFICATION. Medium-sized stingray with a broad, rhombic disc, flat denticles forming wide band on central disc in adults, enlarged pointed denticles on snout, pearl-like thorns on mid-shoulder, no thorns on mid-line of tail before sting, well-developed ventral tail fold followed by long filament, and uniformly brown above. Disc width 1–1.1 times its length; anterior margins concave, apices narrowly rounded. Snout triangular, often with very small lobe at tip. Eyes small, length of orbit and spiracle 2.2–3 in snout length; interorbital space broad, exceeding 3 times orbit length. Mouth small, not greatly protrusible; 5 oral papillae, jaws arched, bulbous and interlocking. Nasal curtain rather broad and short, bilobed; nostrils slit-like, oblique. Denticle band distinct, snout apex covered in denticles with spear-shaped or fork-shaped crowns. Thorn-like denticles confined to mid-disc. Tail long, length 2.2–3.2 times DW; base rather broad and depressed, tapering gently and weakly constricted near sting; 1 or 2 caudal stings, positioned well back on tail; ventral fold slender, height behind sting about twice adjacent tail height, base 104–130% DW; dorsal fold absent. Pelvic fins large, tips angular. Total vertebrae ~163–171; monospondylous 35–38; diplospondylous 125–136.

COLOUR. Dorsal surface of disc brown with pale or pinkish tinge near its margin, tail becoming darker towards tip. Undersurface including tail usually white; ventral fold pale to brownish.

SIZE. Attains at least 69 cm DW (exceeding 150 cm TL). Males mature at 36–39 cm DW; born at ~20 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Sumatra, Java and Borneo. Narrowly distributed and uncommon; probably mainly inshore on continental shelf and near estuaries. Nothing known of its biology.

SIMILAR SPECIES. The similar Starrynose Cowtail Ray (25.69) from Borneo has distinctive, star-shaped denticles at the snout tip and prominent thorns on the tail (both absent in this species).

STARRYNOSE COWTAIL RAY 25.69

Pastinachus stellurostris Last, Fahmi & Naylor, 2010

NE

IDENTIFICATION. Small stingray with a broad, weakly rhombic disc, flat denticles forming wide band on central disc in adults, enlarged starry-based denticles on snout, pearl-like thorns on mid-shoulder and row of sharp thorns on mid-line of tail, well-developed ventral tail fold followed by long filament, and uniformly dark brown above. Disc width 1–1.1 times its length; anterior margins weakly concave, apices broadly rounded. Snout angular, with small lobe at tip. Eyes small, length of orbit and spiracle 2.3–2.4 in snout length; interorbital space broad, exceeding 3.5 times orbit length. Mouth small, not greatly protrusible; jaws arched, bulbous and interlocking. Nasal curtain broad, weakly bilobed; nostrils slit-like, oblique. Denticle band distinct, snout apex covered in denticles with star-shaped crowns. Thorns present on shoulder and along mid-line of tail. Tail long, length 2.4–2.7 times DW; base rather broad and depressed, tapering gently and not noticeably constricted near caudal sting; usually 1 caudal sting positioned well back on tail; ventral fold narrow, height behind sting just exceeding adjacent tail height, base ~110% DW; dorsal fold absent. Pelvic fins large, tips angular. Total vertebrae ~159–161; monospondylous 36; diplospondylous 123–125.

COLOUR. Dorsal surface of disc and tail plain dark brown with greenish tinge. Undersurface, including tail, usually uniformly white; ventral fold pale bluish brown.

SIZE. Attains at least 43 cm DW; males mature at ~41 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; off Kalimantan (Indonesia), range probably restricted within Archipelago. Demersal inshore on soft substrates. Nothing known of its biology.

SIMILAR SPECIES. Very similar in appearance to the Roughnose Cowtail Ray (25.68), but has distinctive star-shaped denticles at snout tip and thorns on the mid-line of the tail, which are both lacking in the Roughnose Cowtail Ray.

BLEEKER'S WHIPRAY

25.70

Pateobatis bleekeri (Blyth, 1860)

NE

IDENTIFICATION. Large, plain-coloured whipray having a subcircular disc with long and pointed snout, nasal curtain skirt-shaped, very broad denticle band in adults, usually 1 large pearl-like thorn on mid-disc, tail whip-like without skin folds, and tail not banded. Disc length 1–1.1 times width; not thickened through trunk; pectoral-fin apex broadly rounded. Snout pointed, length of orbit and spiracle 3.2–4 in snout length; apical lobe broadly triangular, anterior margins weakly to moderately concave. Eyes small, interorbital distance 2.5–2.9 times orbit length. Mouth arched slightly, 2 oral papillae (situated close together); labial furrows and folds prominent. Nasal curtain posterior margin fringed. Denticle band flask-shaped, sharply defined in adults, its edge rounded anteriorly, and then tapering to tail; its width immediately behind spiracles often more than 2.5 times interorbital width; rest of disc smooth. Pearl thorn greatly enlarged and prominent in young, still obvious but less so in large individuals; a few additional slightly enlarged denticles before and after pearl thorn; no other enlarged thorns or denticles on disc or tail. Tail narrow-based, subcircular in cross-section; slender, tapering evenly toward caudal sting; tapering weakly beyond sting, becoming whip-like; length ~3.3 or more times DW; usually 1 caudal sting. Pelvic fin tips narrowly rounded.

COLOUR. Dorsal disc uniformly brownish (greenish brown centrally); tail brownish, darker dorsally than ventrally. Ventral surface white with dark margins in young; becoming almost entirely dark, with occasional whitish patches in adults.

SIZE. Attains ~119 cm DW (possibly 400 cm TL); males and females mature at ~51 cm DW.

HABITAT AND BIOLOGY. Northern Indian Ocean; Pakistan to Myanmar, but range needs to be better defined. Demersal, mainly on muddy bottoms to depths of at least 40 m. Most likely feeds on small crustaceans.

SIMILAR SPECIES. The similar Whitenose Whipray (25.74) differs in having a broader snout, more prominent pearl thorn on the mid-shoulder region, and darker ventral surface. Also, their distributions do not overlap.

PINK WHIPRAY

25.71

Pateobatis fai (Jordan & Seale, 1906)

VU

IDENTIFICATION. Large, plain-coloured whipray with a rhombic disc, nasal curtain skirt-shaped, without obvious band of denticles on central disc nor enlarged thorny denticles on mid-line of disc and tail before caudal sting, tail narrow-based and whip-like without skin folds, and no banded colour pattern on tail. Disc rather broad through trunk, width 1.1–1.2 times length; pectoral-fin apex narrowly rounded. Snout rather short, extremely broad, with an enlarged triangular apical lobe, anterior margins weakly convex. Eyes small, protruding slightly, length of orbit and spiracle 1.9–2.3 in snout length; interorbital space 1.8–2.2 times orbit length. Mouth small, 4 oral papillae (medial pair enlarged, lateral 2 minute); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain subrectangular, posterior margin finely fringed. Mid-shoulder denticles sparse, in a loosely defined band (most prominent in specimens of ~50 cm DW, band becoming indiscernible larger than 90 cm DW). Tail narrow, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 2–2.6 times DW; usually 1 caudal sting; tail beyond caudal sting sparsely covered with denticles.

COLOUR. Dorsal surface pale pinkish brown to greyish with dark dendritic markings on disc margin; small white patch anterior to orbits and spiracles; tail black behind sting. Ventral surface white with broad dark margin behind mouth level.

SIZE. Attains at least 146 cm DW (exceeding 308 cm TL). Males mature at ~112 cm DW; born at ~30 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; South Africa to Central Pacific Islands, north to Okinawa (Japan), wide-ranging. Mainly soft sandy bottoms and coral rubble, nearshore to at least 70 m depths. Feeds mainly on small fishes and prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Most similar to Jenkins' Whipray (25.73) with which it co-occurs in the Indo–West Pacific, but it lacks the distinctive row of enlarged thorns along the mid-disc and tail that is diagnostic for that species.

HORTLE'S WHIPRAY

25.72

Pateobatis hortlei (Last, Manjaji-Matsumoto & Kailola, 2006)

VU

IDENTIFICATION. Medium-sized, plain-coloured whipray with a subcircular disc, very long pointed snout, well-developed band of denticles on central disc with triangular extension forward of eyes in adults, nasal curtain skirt-shaped, tail long and whip-like without skin folds, no banded colour pattern on tail, and vivid yellowish ventral surface when fresh. Disc not thickened through trunk, length ~1.1 times width; pectoral-fin apex broadly rounded. Snout extremely elongate; apical lobe triangular and enlarged; anterior margins strongly concave. Eyes very small, length of orbit and spiracle up to 5.5 in snout length; interorbital width 3.8–4.7 times orbit length in young, up to 6.2 times in adults. Mouth very small, not greatly protrusible; no oral papillae, instead with a thin skin fold; labial furrows and folds weak; lower jaw arched slightly. Nasal curtain with posterior margin finely fringed. Denticles of mid-shoulder region sparse, densely clustered within well-developed band, rest of disc smooth; 1–3 largest mid-shoulder denticles pearl-like; denticles sparse towards tail tip. No thorn-like denticles on disc or tail. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 2.9–3.1 times DW; 1 or 2 caudal stings.

COLOUR. Dorsal surface dark greenish brown (young) to yellowish (adults); tail uniformly brownish behind sting. Ventral surface white (vivid yellow in fresh material).

SIZE. Attains 71 cm DW (~240 cm TL).

HABITAT AND BIOLOGY. Eastern Indian Ocean and Western Central Pacific; eastern Indonesia (Irian Jaya), Papua New Guinea and northern Australia. Demersal, mainly nearshore on soft muddy bottoms, often in vicinity of river mouths and estuaries. Probably feeds mainly on small fishes or prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Body shape resembles the larger Tubemouth Whipray (25.88) and Whitenose Whipray (25.74) from the Indian Ocean. The Tubemouth Whipray also has a highly protrusible mouth.

JENKINS' WHIPRAY

25.73

Pateobatis jenkinsii (Annandale, 1909)

VU

IDENTIFICATION. Large whipray with a broad rhombic disc, nasal curtain skirt-shaped, narrow asymmetric band of denticles on central disc, row of enlarged thorny denticles along mid-line of disc and tail before caudal sting, tail short and whip-like without skin folds, and plain coloured without light and dark bands on tail. Disc with robust trunk, width ~1.1 times length; pectoral-fin apex narrowly rounded. Snout moderately broad, obtuse, rather short; apical lobe small and triangular; anterior margins straight. Eyes small, protruding slightly, length of orbit and spiracle 2–2.5 in snout length; interorbital space 1.3–2.4 times orbit length. Mouth small to moderately wide, 2–4 oral papillae (medial pair enlarged, lateral 2 minute); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain expanded posteriorly, posterior margin finely fringed. Mid-shoulder denticles dense, in well-defined narrow band; band usually constricted over gill arches. Thorns prominent, wedge-shaped, much taller than surrounding denticles. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; not elongate, length 1.1–1.4 times DW; usually 1 caudal sting, but large adults with up to 3 caudal stings.

COLOUR. Dorsal surface yellowish brown; tail blackish beyond sting. Ventral surface white.

SIZE. Attains ~150 cm DW (>300 cm TL). Males mature at ~70 cm DW; born at~23 cm DW.

HABITAT AND BIOLOGY. Indo–Pacific; South Africa to New Guinea, north to Philippines. Mainly benthic on sandy bottoms to depths of ~90 m, also shelters in caves and under ledges on reefs. Probably feeds mainly on small fishes and prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Resembles the Pink Whipray (25.71), another widespread Indo–West Pacific species, but differs in having a row of well-developed thorns extending along the mid-disc and tail, a feature unique within large whiptail stingrays.

WHITENOSE WHIPRAY

25.74

Pateobatis uarnacoides (Bleeker, 1852)

VU

IDENTIFICATION. Large, plain-coloured whipray with a subcircular disc, long and narrowly pointed snout, nasal curtain skirt-shaped, broad denticle band in adults, usually 2 broad pearl-like thorns on mid-disc, tail whip-like without skin folds, and no bands on tail. Disc length ~1.1 times width; not especially broad through trunk, raised slightly on shoulder; pectoral-fin apex broadly rounded. Snout long, apical lobe prominent and triangular; anterior margins strongly concave. Eyes small, length of orbit and spiracle 2.8–3.2 in snout length; interorbital distance 2.1–3.6 times orbit length, largest in adults. Mouth arched, 2–4 oral papillae (situated close together); labial furrows and folds prominent. Nasal curtain posterior margin finely fringed. Denticle band well defined in adults, its edge rounded anteriorly, much wider than twice interorbital width beside eyes, and then tapering slightly to tail; rest of disc smooth. Pearl-shaped thorns on mid-disc much larger than those adjacent, less so in large individuals; no thorns on tail. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 3.1–4.1 times DW; 1 caudal sting; tail beyond caudal sting sparsely covered with denticles. Pelvic fins narrowly rounded.

COLOUR. Dorsal surface greyish or brownish; tail brownish behind sting. Ventral surface greyish brown, with narrow medial area pale.

SIZE. Attains ~119 cm DW (300 cm TL). Males mature at ~50 cm DW; born at ~18 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Java to Vietnam, including Sumatra and Borneo. Mainly demersal on soft bottoms, offshore beyond 30 m depths. Biology little known but feeds mainly on prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Very similar to Bleeker's Whipray (25.70), but distributions of these species do not appear to overlap. Also similar to the Tubemouth Whipray (25.88), Hortle's Whipray (25.72) and Round Whipray (25.50), all from the Indo–Malay Archipelago.

PELAGIC STINGRAY

25.75

Pteroplatytrygon violacea (Bonaparte, 1832)

LC

IDENTIFICATION. Medium-sized stingray with a flattened, cone-shaped disc, broad head, continuous row of small thorns along back, whip-like tail with only ventral tail fold well developed, and all surfaces uniformly dark. Disc broad, width 1.3–1.4 times length; anterior margins evenly rounded, trunk very thick; pectoral-fin apex and rear tip angular. Snout very short and obtuse, very small apical lobe at tip. Eyes very small, length of orbit and spiracle ~1.1–1.3 in snout length; interorbital space very broad. Mouth small with numerous short, bifurcated oral papillae; labial furrows and folds prominent; lower jaw weakly convex. Nasal curtain skirt-shaped, short, very broad, fringe weak; nostrils short, circular. Thorns small, in single row from nape to sting. Granular denticles usually only present in large females. Tail broad based, slightly depressed anteriorly, tapering strongly, becoming whip-like beyond caudal sting; exceeding twice length of disc (when undamaged); 1 or 2 caudal stings; ventral cutaneous fold low, elongate, extending onto posterior half of tail beyond sting; dorsal fold rudimentary or absent. Pelvic fins rounded, usually barely extended beyond disc.

COLOUR. Upper surface, tail folds and whip-like portion of tail uniformly black. Ventral surface of disc and tail dark brownish or black. Cloaca, thorns and sting mostly pale.

SIZE. Attains ~80 cm DW, but usually less than 60 cm DW (130 cm TL); males mature at 35–38 cm DW, females 39–50 cm DW; born at ~14–20 cm DW.

HABITAT AND BIOLOGY. Cosmopolitan and pelagic in all tropical and temperate oceans. Litters of 2–9 pups; gestation period of 2–4 months. Feeds mainly on jellyfishes, squids, crustaceans and fishes. Common bycatch but usually discarded.

SIMILAR SPECIES. No other stingray has a modified disc resembling a flattened cone, nor one so uniformly dark on both dorsal and ventral surfaces.

OCEANIA FANTAIL RAY

25.76

Taeniura lessoni Last, White & Naylor, 2016

NE

IDENTIFICATION. Very small stingray with an oval disc and short tail, denticles and small thornlets on disc of adults, prominent ventral tail fold extending to tail tip, and disc upper surface covered with large blue spots but tail upper edge lacking pair of blue stripes. Disc narrower than long, width ~0.9 of length. Snout short, very obtuse, tip fleshy and not pointed. Eyes large and well protruding, length of orbit and spiracle about half snout length; interorbital space narrow. Mouth medium-sized, 2 medium-sized oral papillae; labial furrows deep, lower lip and nasal curtain with prominent papillae; lower jaw weakly concave near symphysis. Nasal curtain narrow, elongate; posterior margin concave with prominent fringe; nostrils long, narrow and slightly oblique. Upper surface smooth in young, covered with small, widely spaced denticles in adults; disc of adults with 1–2 median rows of small thornlets (absent from tail). Tail length 1.6–1.7 times DW; broad based and depressed anteriorly, tapering gradually to caudal sting, weakly compressed beyond sting; 1 or 2 caudal stings located posteriorly on tail; ventral fold extending along posterior half of tail; dorsal mid-line beyond sting with low angular fleshy ridge. Pelvic fins barely extended beyond disc.

COLOUR. Yellowish brown to orange above; disc and pelvic fins densely covered with vivid blue spots; largest spots often exceeding half eye diameter. No mid-lateral blue stripes on tail; tip white. Ventral surface white, broad, sharply defined yellowish margin on disc and pelvic-fin tips.

SIZE. Attains at least 22 cm DW (~56 cm TL); this male specimen was sexually mature.

HABITAT AND BIOLOGY. Western Pacific; Papua New Guinea, Solomon Islands and Fiji. Benthic, mainly inshore on coral reefs shallower than 20 m depth. Lives in caves and under ledges during day, more active and feeding at night.

SIMILAR SPECIES. Confused with the Bluespotted Fantail Ray (25.77) in parts of the Western Pacific, but the Oceania Fantail Ray lacks a distinctive pair of broad blue stripes on the tail.

BLUESPOTTED FANTAIL RAY

25.77

Taeniura lymma (Forsskål, 1775)

NT

IDENTIFICATION. Small stingray with an oval disc and short tail, small thorn patches in adults, prominent ventral tail fold extending to tail tip, and disc upper surface with blue spots and tail edge with blue stripes. Disc narrower than long, width ~0.8 of length. Snout short, very obtuse, tip not pointed. Eyes large and well protruding, length of orbit and spiracle about half snout length; interorbital space narrow. Mouth medium-sized, 2 large oral papillae; labial furrows deep, lower lip and nasal curtain with prominent papillae; lower jaw weakly concave near symphysis. Nasal curtain narrow, elongate; posterior margin v-shaped with prominent fringe; nostrils long, narrow. Disc smooth except for small patch of widely spaced nuchal thorns and sometimes with short row posteriorly. Tail length ~1.5 times disc width; broad based and depressed anteriorly, tapering gradually to caudal sting, weakly compressed beyond sting; usually with 2 caudal stings located posteriorly on tail; ventral cutaneous fold extending along posterior half of tail; dorsal mid-line with very low fleshy ridge. Pelvic fins barely extended beyond disc.

COLOUR. Brownish, yellowish brown or orange above; disc and pelvic fins densely covered with large blue spots; largest spots about half eye diameter. Tail with pair of mid-lateral blue stripes before sting; tip white. Ventral surface white, often with broad yellowish margin on disc.

SIZE. Attains ~35 cm DW (~75 cm TL). Males mature at ~20 cm DW; born at 13–14 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; South Africa to eastern Australia. Benthic, mainly inshore shallower than 20 m depth. Lives primarily around coral reefs, sheltering in caves and under ledges during day. Feeds at night, largely on marine worms and bivalves.

SIMILAR SPECIES. A second species of this genus, the Oceania Fantail Ray (25.76), which was discovered recently in the Solomon Islands, differs from the Bluespotted Fantail Ray in lacking a pair of blue stripes on the tail.

ROUND STINGRAY

25.78

Taeniurops grabatus (Geoffroy Saint-Hilaire, 1817)

DD

IDENTIFICATION. Large stingray with a subcircular disc, no enlarged thorns and sparse coverage of denticles, short tail with prominent ventral fold tapering to tail tip, and upper surface plain brown or weakly speckled. Disc slightly wider than long, trunk robust. Snout moderately elongate, broadly angular, tip pointed. Eyes small, length of orbit and spiracle ~2.2 in snout length; interorbital space broad, more than twice orbit length. Mouth small, labial papillae and furrows well developed; lower jaw concave at symphysis. Nasal curtain skirt-shaped, short, broad, fringe well developed; nostrils small, oval. Skin rough in places, widely spaced denticles and low thornlets dispersed centrally over upper disc and tail. Tail slightly exceeding disc width, narrow-based, rounded above and flattened below, tapering to caudal sting, compressed beyond sting; usually 1 long caudal sting; ventral fold slender but well developed, height behind sting slightly less than adjacent tail height; dorsal fold absent. Pelvic fins barely extended beyond disc.

COLOUR. Pale to medium brown above, sometimes with darker speckling; skin fold and tail behind sting uniformly black. Ventral surface of disc mostly pale; disc and pelvic fins with sharply defined brownish margins; undersurface of tail uniformly brownish black.

SIZE. Attains at least 100 cm DW (~150 cm TL, but reported to reach 250 cm TL in Eastern Atlantic).

HABITAT AND BIOLOGY. Eastern Atlantic; France to Angola, including Mediterranean Sea (possibly also Red Sea). Demersal inshore on soft bottoms to ~100 m depth. Feeds on small benthic fishes and crustaceans.

SIMILAR SPECIES. Similar to the Blotched Stingray (25.79) and the two species may overlap in distribution in the Eastern Mediterranean or Red Sea. The Blotched Stingray is larger, and usually has a more mottled upper disc and deeper ventral fold on the tail.

BLOTCHED STINGRAY 25.79

Taeniurops meyeni (Müller & Henle, 1841)

VU

IDENTIFICATION. Very large stingray with a subcircular disc, small thorn patches in adults, short tail with deep ventral fold extending to tail tip, and upper surface usually mottled black and white. Disc slightly wider than long, trunk massive. Snout short, very obtuse, tip not pointed. Eyes small, length of orbit and spiracle about half snout length; interorbital space broad, more than twice orbit length. Mouth broad, 7 short oral papillae; labial furrows and folds weak; lower jaw convex. Nasal curtain skirt-shaped, short, very broad, fringe short; nostrils large, oval. Thornlets short, clustered in narrow band along mid-body and in 2 small patches on each shoulder; absent in young. Disc surface of adults granular, covered with short star-shaped denticles. Tail slightly exceeding DW, very broad based, depressed anteriorly, tapering strongly to sting, compressed beyond sting; usually 1 sting; ventral fold very well developed, several times deeper than tail; dorsal fold absent. Pelvic fins barely extend beyond disc.

COLOUR. Dorsal surface usually mottled black and white, sometimes uniformly brownish or black; skin fold and tail behind sting uniformly black. Ventral surface of disc pale; disc margin and undersurface of tail greyish brown to black, particularly in young.

SIZE. Attains ~180 cm DW (~330 cm TL). Males mature at 100–110 cm DW; born at 30–35 cm DW (55–65 cm TL).

HABITAT AND BIOLOGY. Indo–West Pacific; South Africa to New Caledonia, north to China and Japan. Common and widespread in tropical seas, mainly inshore but reported from more than 400 m depth. Litters of up to 7 pups. Feeds on benthic invertebrates and fishes.

SIMILAR SPECIES. The smaller Round Stingray (25.78), which also has a subcircular disc and long ventral fold on the tail, has a smoother disc, narrower ventral fold, and its dorsal surface is not densely covered with speckles and blotches.

SHARPNOSE RAY

25.80

Telatrygon acutirostra (Nishida & Nakaya, 1988)

NT

IDENTIFICATION. Medium-sized, plain-coloured stingray with a rhombic disc, very long pointed snout with concave anterior margins, very small eyes, no oral papillae, tail whip-like beyond caudal sting, no obvious dorsal tail fold, and ventral tail fold short-based. Disc strongly depressed, thin through trunk; usually slightly longer than wide; pectoral-fin apex broadly rounded. Snout very elongate and triangular, length 37–44% DW, no obvious lobe at tip. Eyes not protruding, length of orbit and spiracle more than 4 in snout length; interorbital space 2.5–4 times orbit length. Mouth narrow, labial furrows and folds weak or absent; lower jaw convex. Nasal curtain skirt-shaped, short and broad; margin fringed; nostrils oval, not oblique. Skin smooth, denticles only present on posterior tail of adults. Thorns absent in young; small and in narrow row on mid-disc and tail before caudal sting in adults. Tail very narrow-based, barely tapering, whip-like beyond sting; length 2.3–3 times DW; usually 1 caudal sting; ventral fold low, short (base 15–23% DW); dorsal fold reduced to a low ridge or absent. Pelvic fins small, narrowly triangular.

COLOUR. Uniformly yellowish to brown above, spiracle white; tail base similar to disc, becoming progressively darker beyond caudal sting. Ventral surface white with well-defined dusky margin; tail base white, usually dusky or black beyond sting.

SIZE. Attains ~73 cm DW (possibly up to 200 cm TL).

HABITAT AND BIOLOGY. North-West Pacific; central China to southern Japan. Demersal on continental shelf, at depths of 55–140 m. Known from few specimens.

SIMILAR SPECIES. Previously placed in the genus *Dasyatis* and now provisionally in *Telatrygon*. Disc shape similar to the co-occurring Pale-edge Sharpnose Ray (25.83), but has a much longer snout, relatively smaller eyes, and lacks a conspicuous dorsal tail fold. The enigmatic Taiwanese stingray, *Dasyatis microphthalma* Chen, of uncertain identity because no collection specimens still exist, is possibly the same as this species.

INDONESIAN SHARPNOSE RAY

25.81

Telatrygon biasa Last, White & Naylor, 2016

NE

IDENTIFICATION. Small, plain-coloured stingray with a rhombic disc with deeply concave anterior margins, long pointed snout, no oral papillae, tail filamentous beyond caudal sting, low dorsal tail fold present, and ventral tail fold long-based. Disc thin through trunk, width subequal to its length; pectoral-fin apex broadly rounded. Snout tip narrow and angular, length 28–31% DW. Eyes small, not protruding, length of orbit and spiracle ~2.9 in snout length; interorbital space 1.6–1.9 times orbit length. Mouth narrow, labial furrows and folds weak; lower jaw strongly arched. Nasal curtain narrowly skirt-shaped; margin finely fringed; nostrils slit-like, short, not oblique. Skin largely smooth, lacking denticles even in adults. Thorns absent in young and adolescents; broken row of small median thorns on disc and up to 8 narrow, ridge-like thorns on tail before caudal sting in adults. Tail narrow-based, depressed slightly; tapering then becoming filamentous beyond caudal sting; length 1.5–1.9 times DW; 1 or 2 (usually 1) narrow caudal stings; ventral fold low, long and variable (base 58–83% DW); dorsal fold long, base 1.5–3 times longer than interorbital width; skin folds commencing and ending as low fleshy ridges. Pelvic fins small, narrowly triangular.

COLOUR. Disc uniform orange brown, often slightly paler or translucent laterally; thorns whitish. Ventral surfaces of disc and tail before sting white. Tail beyond sting with upper and lower surfaces including skin folds brownish or dusky, white laterally.

SIZE. Attains ~29 cm DW. Males mature at 17–18 cm DW, females 18–19 cm DW; born at 7–10 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Indonesia and Malaysian Borneo. Demersal on continental and insular shelves to 40 m depths. Litters of 1–4 pups. Feeds mainly on small crustaceans and fishes.

SIMILAR SPECIES. Similar to the Pale-edge Sharpnose Ray (25.83), which has a slightly longer snout and wider interorbit. A similar form occurs off Philippines but the identity of that population has not been resolved.

INDIAN SHARPNOSE RAY

25.82

Telatrygon crozieri (Blyth, 1860)

NE

IDENTIFICATION. Small to medium-sized, plain-coloured stingray with a weakly rhombic disc with long pointed snout and deeply concave anterior margins, no oral papillae, tail filamentous beyond caudal sting, dorsal tail fold prominent, and ventral tail fold long. Disc thin through trunk, width slightly shorter than its length; pectoral-fin apex broadly rounded. Snout elongate, tip narrow and angular, length 33–36% DW. Eyes small, not protruding, length of orbit and spiracle 3.3–3.7 in snout length; interorbital 2.4–2.5 times orbit length. Mouth narrow; labial furrows and folds weak; lower jaw very convex. Nasal curtain narrowly skirt-shaped; margin finely fringed; nostrils slit-like, not oblique. Skin largely smooth, lacking denticles even in adults. Short, single row of small thornlets on nape; up to 12 much larger, very narrow, spear-shaped thorns with large oval bases on tail before sting in adults. Tail narrow-based, depressed slightly; tapering then becoming filamentous beyond caudal sting; length 1.7–2.2 times DW; usually 1 caudal sting; ventral fold low, long (base 65–67% DW); dorsal fold base 3 or more times interorbital width. Pelvic fins very small, narrowly triangular.

COLOUR. Uniformly dark brown above. Ventral surface white; margin dark, broad and usually entirely brownish; central disc blotchy brown and white. Tail beyond sting usually dusky above and below, sides paler than upper and lower surfaces or folds.

SIZE. Attains at least 40 cm DW (possibly ~120 cm TL). Males mature at ~28 cm DW, females ~30 cm DW; born at ~8 cm DW.

HABITAT AND BIOLOGY. Northern Indian Ocean; Arabian Sea (India) to Myanmar. Demersal on continental shelf; taken as a small bycatch component of trawl fisheries off India. Thought to move inshore to breed. Litters of probably 2 pups.

SIMILAR SPECIES. Resembles the Pale-edge Sharpnose Ray (25.83), but has a longer snout and tail, and smaller eyes and pelvic fins.

PALE-EDGE SHARPNOSE RAY

25.83

Telatrygon zugei (Müller & Henle, 1841)

NT

IDENTIFICATION. Small, plain-coloured stingray with a weak rhombic disc with long pointed snout and deeply concave anterior margins, no oral papillae, tail filamentous beyond caudal sting, dorsal tail fold present, and ventral fold long-based. Disc thin through trunk, width slightly shorter than its length; pectoral-fin apex narrowly rounded. Snout tip narrow and angular, length 31–34% DW. Eyes small, not protruding, length of orbit and spiracle 3.1–3.6 in preorbital snout length; interorbital 1.9–2.4 times orbit length. Mouth narrow, labial furrows and folds weak; lower jaw convex. Nasal curtain narrowly skirt-shaped; margin finely fringed; nostrils slit-like, not oblique. Skin smooth, lacking denticles even in adults. Thorns absent in young, but up to 9 narrow, ridge-like thorns on tail before sting in adults; row of small nuchal thorns often in adults. Tail narrow-based, depressed slightly; tapering then becoming filamentous beyond caudal sting; length 1.4–1.6 times DW; usually 1 caudal sting; ventral fold long, low (base 72–91% DW); dorsal fold low. Pelvic fins small, narrowly triangular.

COLOUR. Uniformly dark brown to greenish brown above, often with a paler pinkish tinge laterally, tubercles, spiracle and preorbit white; tail base similar to disc, darker beyond caudal sting with white edge; dorsal fold dark. Ventral surface white or with dusky margin, tail beyond sting usually dusky or black, fold pale.

SIZE. Attains ~29 cm DW (~80 cm TL), usually less than 24 cm DW; born at 8–10 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; Vietnam to Japan, possibly also Philippines and Thailand. Demersal on continental shelf to ~100 m depths. Substantial bycatch of regional trawl fisheries. Litters of 1–3 pups. Diet unknown.

SIMILAR SPECIES. Once thought to be widespread (south to Indonesia and west to India), but these populations are now known to belong to other members of a species complex. The Indonesian Sharpnose Ray (25.81) has a slightly shorter snout and narrower interorbital space.

MUMBURARR WHIPRAY

25.84

Urogymnus acanthobothrium Last, White & Kyne, 2016

NE

IDENTIFICATION. Very large whipray with an oval disc with rough skin in adults, very small eyes and large spiracles, nasal curtain skirt-shaped, well-developed denticle band but no thorns, tail whip-like without skin folds, upper surface without white flecks, and tail uniformly white in young (without bands). Disc very thick through trunk in adults, length ~1.1 times width; pectoral-fin apex broadly rounded. Snout moderately elongate, with a small triangular apical lobe, anterior margins almost straight. Eyes protruding, length of orbit and spiracle ~2.5 in snout length; interorbital space ~2.9 times orbit length. Mouth small, ~7 oral papillae (5 medially); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain small, with posterior margin finely fringed. Denticle band on disc well developed, without sharply demarcated edges, mid-shoulder denticles sparse; no enlarged thorns or thornlets on body (sometimes weak thorn on shoulder in young). Tail rather narrow-based, subcircular to oval in cross-section; tapering very gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length ~2.3-2.4 times DW; usually 1 caudal sting.

COLOUR. Dorsal surface of adults brownish (small juveniles greyish, subadults distinctly yellowish), often irregularly covered with fine greyish speckles. Tail much paler, sting and posterior tail uniformly white (less obvious in large adults). Ventral surface white.

SIZE. Attains at least 161 cm DW (pregnant female). Adult male 110 cm DW, adolescent male at 103 cm DW; aborted embryo ~27 cm DW.

HABITAT AND BIOLOGY. Western Central Pacific; northern Australia and southern Papua New Guinea. Young enter rivers and estuaries; adults coastal on inner continental shelf on soft bottoms, to depths of at least 60 m. Diet unknown.

SIMILAR SPECIES. One of the largest stingrays but surprisingly only recently discovered and named. Probably confused with the Mangrove Whipray (25.87) as both species have a characteristic white whip-like tail. The Mumburarr Whipray lacks white flecks over the disc, which are prominent on the Mangrove Whipray.

PORCUPINE WHIPRAY

25.85

Urogymnus asperrimus (Bloch & Schneider, 1801)

VU

IDENTIFICATION. Large whipray with a robust oval to subcircular disc, upper surface extremely rough and prickly, very short tail without caudal stings and skin folds, and plain coloured dorsally. Disc greatly thickened, usually slightly narrower than long; pectoral-fin apex broadly rounded. Snout short, obtuse, tip with short lobe. Eyes small, well protruding, length of orbit and spiracle 1.5–2 in snout length; interorbital space very broad, more than 4 times orbit length in adults. Mouth narrow, 3–5 oral papillae; labial furrows and papillae prominent; lower jaw weakly concave near symphysis. Nasal curtain small, skirt-shaped, fringe prominent; nostrils long, slit-like. Upper mid-disc and tail densely covered with a broad band of flat, plate-like denticles; denticles interspersed with fewer, taller and sharper upright thorns in adults; no distinct mid-shoulder or orbital thorn patches; outer disc with fewer denticles but similar coverage of upright thorns. Tail slender, about equal to disc length, almost cylindrical in cross-section, tapering rapidly to tip; without caudal stings or cutaneous folds. Pelvic fins small, narrow, barely extended beyond disc.

COLOUR. Uniformly brownish, yellowish or greyish above, thorns often paler; posterior half of tail black. Ventral surface uniformly white.

SIZE. Attains at least 115 cm DW (~147 cm TL). Males mature at ~90 cm DW, females ~100 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific and possibly Eastern Atlantic; widespread. Most abundant inshore over soft bottoms; feeds by ploughing up sediment to gather marine worms, as well as crabs and bivalves. Little known of its biology.

SIMILAR SPECIES. A combination of a rounded disc with a very spiny upper surface, and short tail without skin folds and a caudal sting, make it distinct from all other stingrays. The Mangrove Whipray (25.87), which also has a rough oval disc, can appear similar when viewed underwater.

FRESHWATER WHIPRAY

25.86

Urogymnus dalyensis (Last & Manjaji-Matsumoto, 2008)

LC

IDENTIFICATION. Large, plain-coloured whipray with an oval to subcircular disc with an enlarged triangular apical lobe, very small eyes, nasal curtain skirt-shaped, granular denticles over entire disc but not in well-defined band, and tail whip-like without skin folds. Disc with rather thin trunk, length ~ 1–1.1 times width; pectoral-fin apex broadly rounded. Snout long, extremely broad, anterior margins almost truncated. Eyes protruding slightly, length of orbit and spiracle 2.6–3.2 in snout length; interorbital space 1.3–1.6 times orbit length in young. Mouth small, 4 oral papillae (central 2 enlarged); labial furrows and folds indistinct; lower jaw arched slightly. Nasal curtain broad, posterior margin finely fringed. Mid-shoulder denticles sparse, 2–4 greatly enlarged mid-shoulder denticles. Tail narrow-based, compressed to subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 1.9–2.2 times DW; usually 1 caudal sting; entirely covered in denticles.

COLOUR. Dorsal surface greyish to yellowish brown with dark dendritic pores on disc margin; tail greyish above, pale below forward of sting, blackish behind sting (not banded). Ventral surface white with broad dark grey margin behind apical lobe; mostly with irregular greyish spots centrally.

SIZE. Attains ~124 cm DW (exceeding 270 cm TL); males mature at ~90 cm DW.

HABITAT AND BIOLOGY. Western Central and South-West Pacific; northern Australia and New Guinea (Fly River Basin). Benthic, mainly in rivers, estuaries and low salinity coastal environments. Feeds mainly on small fishes and prawns, which it actively pursues, even beaching itself to trap prey.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Resembles the Giant Freshwater Whipray (25.89) from further west and north in the Indo–West Pacific, which is much larger (nearly 200 cm DW and possibly weighing 600 kg).

MANGROVE WHIPRAY

25.87

Urogymnus granulatus (Macleay, 1883)

VU

IDENTIFICATION. Large whipray with an oval disc, rough skin, nasal curtain skirt-shaped, well-developed band of denticles on central disc (none greatly enlarged), tail whip-like without skin folds, upper surface greyish brown with small white flecks, and posterior tail white (without bands). Disc very thick through trunk, distinctly longer than wide; pectoral-fin apex broadly rounded. Snout short, with a weak apical lobe, anterior margins convex to straight; eyes protruding in both young and adults. Eyes small, protruding, length of orbit and spiracle ~1.5–2 in snout length; interorbital space 1.3–2.8 times orbit length. Mouth small, 2–7 oral papillae (medial pair enlarged); labial furrows and folds prominent; lower jaw arched slightly. Nasal curtain small, with posterior margin finely fringed. Mid-shoulder denticles sparse, no enlarged thorns or thornlets on body; well-developed denticle band with sparse denticles; no denticles on undersurface or sides of tail. Tail broad based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; length 1.3–2.1 times DW; with 1–2 caudal stings.

COLOUR. Dorsal surface greyish or yellowish brown, covered with small white flecks and often with dark mucus; tail white behind sting. Ventral surface white in young, with dense black blotches in adults; broad dusky or black margin usually around most of disc and outer edges of pelvic fins.

SIZE. Attains at least 141 cm DW (exceeding 350 cm TL). Males mature at 55–65 cm DW; birth size ~14 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; Red Sea to Oceania, distribution considered patchy but probably wide-ranging. Young live mainly in mangroves and estuaries; adults on coral reefs, to at least 85 m depth. Feeds mainly on crabs and prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. The Mumburarr Whipray (25.84), which also has an oval disc and white tail, has a shorter snout and skin on the dorsal surface has white flecks (markings otherwise absent).

TUBEMOUTH WHIPRAY

25.88

Urogymnus lobistoma (Manjaji-Matsumoto & Last, 2006)

VU

IDENTIFICATION. Large, plain-coloured whipray with a subcircular disc, extremely small eyes, mouth highly protrusible, nasal curtain skirt-shaped, obvious band of denticles on central disc, tail whip-like without skin folds, and tail not banded. Disc slightly longer than wide, length ~1.1 times width; pectoral-fin apex broadly rounded. Snout extremely elongate; apical lobe enlarged and triangular; anterior margins strongly concave. Eyes very small, protruding slightly, length of orbit and spiracle 3.7–4.6 in snout length; interorbital distance 3.7–7.1 times orbit length, widest in adults. Mouth small, highly protrusible, no oral papillae, instead with a thin skin fold; labial furrows and folds prominent; lower jaw almost horizontal. Nasal curtain subrectangular, posterior margin finely fringed. Denticles dense, in very broad median band, rest of disc smooth; band triangular anteriorly; denticles becoming sparse towards tail tip. No sharp thorn-like denticles on disc or tail; 2–4 small pearl thorns on mid-disc. Tail narrow-based, subcircular in cross-section; tapering gently and evenly toward caudal sting, then weakly beyond sting, becoming whip-like; long, length 2.6–2.8 times DW; usually 1 caudal sting.

COLOUR. Dorsal surface greyish to light brown, margins of eye and spiracle white; tail greyish beyond sting. Ventral surface white; oronasal area and gill slits dark.

SIZE. Attains ~100 cm DW (>360 cm TL). Males mature at ~49 cm DW, females mature ~70 cm DW; born at ~19 cm DW.

HABITAT AND BIOLOGY. Indo–Malay Archipelago; Sumatra and Borneo. Inshore, probably with restricted distribution in brackish habitats associated with runoff from large rivers. Feeds mainly on small fishes and prawns.

SIMILAR SPECIES. Previously placed in the genus *Himantura*. Has a similar disc shape to the smaller Hortle's Whipray (25.72) from eastern Indonesia, and the Whitenose Whipray (25.74) from the Indo–West Pacific, but differs from both species in having a highly protrusible mouth.

GIANT FRESHWATER WHIPRAY

25.89

Urogymnus polylepis (Bleeker, 1852)

EN

IDENTIFICATION. Very large, plain-coloured whipray with a subcircular to broadly oval disc, snout very broad with enlarged narrow apical lobe, nasal curtain skirt-shaped, minute eyes, skin on upper surface entirely covered with fine granular denticles, thin whip-like tail without skin folds, and tail not banded. Disc with thick trunk and thin, highly flexible pectoral fins; slightly longer than wide, length ~1.1 times width; pectoral-fin apex broadly rounded. Snout long, extremely broad, with pronounced triangular apical lobe; anterior margins without lobe almost truncated. Eyes protruding slightly, length of orbit and spiracle 3.3–4.4 in snout length; interorbital distance 3.2–4.7 times orbit length. Mouth small, 6 oral papillae (central 2 enlarged); labial furrows and folds indistinct; lower jaw arched slightly. Nasal curtain small, broader than long, posterior margin finely fringed. Denticles sparse, covering most of upper disc; edges of main denticle band not sharply defined; 1–6 mid-shoulder denticles, small or inconspicuous. Tail very narrow-based, compressed to subcircular in cross-section; tapering gently and evenly toward caudal sting, almost filamentous beyond sting, whip-like; long, length 2.8–3.1 times DW; 1–3 caudal stings; entirely covered with denticles. Pelvic fins very small with rounded tips.

COLOUR. Dorsal surface uniform greyish or brownish; tail darker, blackish behind sting. Ventral surface white; broad outer margin dark brown or greyish, widest posteriorly and with blotchy inner edge.

SIZE. Attains at least 192 cm DW (~500 cm TL), and possibly 600 kg or more; males mature at ~110 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; India (Bay of Bengal) to Borneo. Inhabits freshwater and low salinity embayments near coast. Feeds mainly on crabs and prawns, which it pursues aggressively.

SIMILAR SPECIES. Among the heaviest members of the dasyatid stingrays. The Freshwater Whipray (25.86) from northern Australia and New Guinea is similar, but has a smaller maximum size (~124 cm DW).

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NEOTROPICAL STINGRAYS

Family Potamotrygonidae

M.R. de Carvalho

Neotropical stingrays are small to large rays (adults 25 cm to 1.8 m DW) with weakly rhomboidal, circular or oval discs (*Heliotrygon* has the roundest disc of all rays). Their tail varies from short, very stout and muscular to extremely long and whip-like, with ridge-like lateral tail folds, and with or without dorsal and ventral tail folds; well-developed ventral fold in *Plesiotrygon*, usually dorsal and ventral ridge-like folds in *Potamotrygon* (sometimes in *Heliotrygon*), low ventral ridge in *Styracura*, and dorsal and ventral folds lacking in *Paratrygon*. Caudal stings vary from very robust (*Potamotrygon*, *Plesiotrygon*, *Styracura*), to slender and small (*Paratrygon*) or vestigial (*Heliotrygon*). The head is not prominently elevated above the disc and the eyes are small to barely noticeable, except in *Potamotrygon*, which has large, bulging eyes. Spiracles are generally large and trapezoidal. Mouth with numerous tooth rows (upwards of 45), and 5 or more vertical papillae on its floor. Dorsal disc and tail with numerous small denticles, large pointed thorns (greater on dorsal tail), and sometimes larger-based tubercles on tail or along disc perimeter (usually 2 pearl-like thorns in *Styracura*). The family, which consists of 34 valid named species, is represented in Central and South America by 2 very distinct subfamilies: 1 for a neotropical marine genus (*Styracura*) and the other for a larger group of neotropical freshwater stingrays, the potamotrygonins (*Heliotrygon*, *Paratrygon, Plesiotrygon, Potamotrygon*); several other new species of freshwater stingrays are currently being described. The vast majority of neotropical freshwater stingrays are very colourful, sometimes with intricate and complex dorsal patterns composed of rosettes, vermiculate and/or reticulate markings, spots and/or ocelli on the disc, pelvic fins, and tail. The differing colour patterns are usually crucial to identify species, even though they vary among individuals; intermediate colour patterns between species also exist. Their beauty and general hardiness in aquaria make them popular in the pet trade, even though many species are illegally exploited. Potamotrygonins are the only living supraspecific chondrichthyan group to have evolved in freshwater environments from a single common ancestor; they occur in many South American rivers that flow into the Caribbean Sea or Atlantic Ocean (but absent from rivers that drain the eastern and north-eastern coasts of Brazil); some species are restricted to single rivers or river basins, whereas others are widespread in the Amazon and/or Paraná-Paraguai and Orinoco basins. Viviparous (most known to be trophodermic), usually with litters of 1–8 pups, and gestation periods of 3–12 months (among the shortest gestations of chondrichthyans). Potamotrygonins are feared by riverine human communities due to the painful wounds inflicted by their venomous caudal stings; venom glands located at ventral base of sting spread venom that accumulates in the ray's mucous coating.

KEY TO POTAMOTRYGONID GENERA

1. Denticles on dorsal mid-disc and shoulder clearly larger than surrounding denticles; usually with 2 much larger pearl spines on shoulder (fig. 1); dorsal colour plain; amphi-American, marine .... ***Styracura* (2 species; fig. 1, pp. 654–655)**

   No greatly enlarged denticles on dorsal mid-disc and shoulder; no pearl spines on shoulder; dorsal colour almost always elaborate, usually with spots, reticulations or other complex patterns 2

2. Tail base broad, its width at base about equal to interorbital distance (fig. 2); snout oval; pelvic fins protruding beyond posterior disc margin in dorsal view (fig. 2); dorsal or ventral (or both) tail folds present; caudal stings distant from tail base (fig. 2) 3

   Tail base slender, its width less or slightly greater than half of interorbital distance (fig. 4); snout broadly rounded (fig. 4) or faintly concave (fig. 5); pelvic fins concealed beneath disc, not visible in dorsal view (fig. 4); dorsal and ventral tail folds absent; caudal stings on tail base (fig. 5) 4

3. Tail short, its length usually about equal to or slightly greater than disc width (fig. 2); eyes large and bulging (fig. 2); dorsal and ventral tail folds both present; South America, freshwater .... ***Potamotrygon* (27 species; fig. 2, pp. 627–653)**

   Tail very long, exceeding twice disc width (fig. 3); eyes small, not bulging (fig. 3); only ventral tail fold present; South America, freshwater .... ***Plesiotrygon* (2 species; fig. 3, pp. 625–626)**

4. Disc almost circular, snout rounded (fig. 4); spiracular knob absent; caudal sting vestigial (sometimes absent) (fig. 6); South America, freshwater .... ***Heliotrygon* (2 species; fig. 4, pp. 622–623)**

   Disc oval, snout faintly concave (fig. 9); spiracular knob present (fig. 8); caudal stings well developed (fig. 7); South America, freshwater .... ***Paratrygon* (1 species; fig. 5, p. 624)**

fig. 1

fig. 2

fig. 3

fig. 4

fig. 5

caudal sting

fig. 6

fig. 7

side view of tail near caudal sting

fig. 8 knob

view of left eye and spiracle

GOMES'S ROUND RAY

26.1

Heliotrygon gomesi Carvalho & Lovejoy, 2011

NE

IDENTIFICATION. Medium-sized freshwater stingray with a remarkably large, circular, thin and flattened disc, only slightly longer than wide (more oval posteriorly), eyes and caudal stings minute, head very flat, and uniform greyish dorsal coloration. Snout broad, elongate, with convex anterior margin, and usually with small rostral knob. Head not elevated. Eyes and spiracles closely adjacent; eyes smaller than spiracles; spiracles smooth, without rim, knob or papillae. Nostrils slightly smaller than orbit length, circular; distance between nostrils equal to mouth width; nasal curtain posteriorly notched. Teeth visible with mouth closed, in ~30 rows in adults. Pelvic fins concealed in dorsal view. Tail very slender at base, its width about half of interorbital distance; tapering, elongate whip-like, usually longer than disc length (but frequently broken); tail proportionally much longer in newborns and juveniles than in adults. Tail with ridge-like lateral folds; dorsal fold absent, ventral fold a low ridge. Caudal sting very reduced in size, shorter or more or less equal to spiracle length; positioned on tail just posterior to end of disc.

COLOUR. Dorsal surface uniform grey, light tan or brown, usually without conspicuous markings. Ventral surface uniform creamy white; some specimens with small, greyish blotches over posterior disc, base of tail, and pelvic fins.

SIZE. Attains ~58 cm DW (84 cm TL). Males mature at 35–40 cm DW; newborns ~12 cm DW (42 cm TL).

HABITAT AND BIOLOGY. South America; upper Amazon River basin, but also further east in lower reaches of other major Amazon tributaries. Appears to rest in deep troughs during day, being more active at night. Important ornamental fish species, usually known as 'China' ray.

SIMILAR SPECIES. Resembles Rosa's Round Ray (26.2), which has a more intricate colour pattern with vermiculate markings, and slightly longer pelvic fins, among other subtle differences.

ROSA'S ROUND RAY

26.2

Heliotrygon rosai Carvalho & Lovejoy, 2011

NE

IDENTIFICATION. Medium-sized freshwater stingray with a markedly circular, slender and flattened disc (only slightly longer than wide), eyes and caudal sting minute, and an elaborate reticulate dorsal colour pattern. Disc more oval posteriorly, widest at mid-length. Snout broadly convex and elongate; minute rostral knob sometimes present. Head low, not elevated. Eyes and spiracles close together; eyes barely detectable, smaller than spiracles; spiracles smooth, without rim, knob or papillae. Nostrils slightly smaller than orbit length, circular; distance between nostrils equal to mouth width; nasal curtain with fringes, posteriorly notched. Teeth visible with mouth closed, in ~28 rows in adults. Pelvic fins concealed in dorsal view. Tail very slender at base, its width about one-half of interorbital distance; tail tapering, whip-like, usually greater than disc length (but frequently broken), much longer in newborns and juveniles. Tail with ridge-like lateral folds; dorsal fold usually absent but ventral fold a low ridge. Caudal sting vestigial, smaller or equal to spiracle length, located on tail just posterior to disc end. Clasper depressed, short.

COLOUR. Dorsal surface brown, tan or grey with numerous tan to whitish vermiculate markings delimiting reticulate patterns; vermiculations may also delimit regularly distributed circular brown areas on dorsal disc. Ventrally creamy white, with darker blotches on posterior disc margins, tail and pelvic fins in larger specimens.

SIZE. Attains about 58 cm DW (98 cm TL), but may reach larger sizes; males mature at 48–58 cm DW; newborns ~12 cm DW.

HABITAT AND BIOLOGY. South America; known from eastern, central and western Amazon River, usually in its central troughs, but also in a few larger tributaries. Feeds on small fishes. An important ornamental species ('Coly' ray).

SIMILAR SPECIES. Similar to Gomes's Round Ray (26.1), but differs in having a reticulate dorsal colour pattern (*vs.* plain).

DISCUS STINGRAY

26.3

Paratrygon aiereba (Müller & Henle, 1841)

DD

IDENTIFICATION. Very large freshwater stingray with a flat, water lily-shaped disc (in large specimens thick and longer than wide), eyes small, spiracles with a posterior knob, and an elaborate reticulate dorsal colour pattern. Snout broad, with distinctive concave anterior margin. Head low. Eyes and spiracles close together; eyes very minute, smaller than spiracles. Nostrils smaller than eye length, subcircular; nasal curtain posteriorly concave. Teeth in ~35 rows in adults. Pelvic fins concealed in dorsal view. Tail slender at base, its width about one-half interorbital distance, and tapering to a whip; usually much longer than disc length in juveniles, but reduced in adults. Tail with ridge-like lateral folds at base. Small denticles on disc and tail, sometimes larger on posterior disc. Larger, sharp thorns with wide bases in irregular rows usually present on dorsal and lateral tail. Caudal stings slender, about equal to interorbital space, on tail base just posterior to disc.

COLOUR. Dorsal surface brownish or purplish brown with complex pattern of darker reticulations, vermiculations, and/or pattern resembling nerve fibres; sometimes with distinct preorbital ('eyebrow') markings. Ventrally creamy white, sometimes with darker posterior disc and pelvic-fin margins.

SIZE. Attains 160 cm DW, but usually to 130 cm DW (lengths of large adults rarely recorded); females may weigh up to 110 kg; newborns ~12–15 cm DW.

HABITAT AND BIOLOGY. South America; widespread in Amazon and Orinoco rivers, and in northern South America. Lives on mud, sand and even rocky bottoms; newborns and juveniles found on beaches and reefs, adults in deeper troughs. Feeds on insect larvae, shrimps, and fishes (catfishes, freshwater anchovies). Usually 1–2 pups per litter, gestation up to 9 months. Females observed associating with newborns after birth. Important aquarium species.

SIMILAR SPECIES. Presently monotypic, but ongoing studies reveal a species complex. Easily distinguished from other freshwater stingrays by its disc shape, colour, spiracles, and caudal thorns and stings.

ANTENNA RAY

26.4

Plesiotrygon iwamae Rosa, Castello & Thorson, 1987

DD

IDENTIFICATION. Medium-sized freshwater stingray with an oval and flat, longer than wide disc, flat head, minute eyes, and usually a light dorsal coloration with irregular ocelli or vermiculate patterns. Snout broadly rounded, elongate, with small rostral knob. Head not elevated. Eyes small, not protruding, much smaller than spiracles; spiracles large, rhomboidal, with smooth rims. Nostrils slit-like; nasal curtain posteriorly notched and fringed. Teeth small, in ~40–60 rows in adults. Pelvic fins protruded greatly from disc. Tail base stout, its width about equal to interorbital distance; tail whip-like, very long, near twice disc length in smaller specimens (slightly reduced in adults); well-developed ventral fold. Disc with scattered small denticles, and larger, pointed thorns in an irregular row on tail base. Caudal stings robust, distant from tail base near tail mid-length.

COLOUR. Dorsal surface grey, brown, or pinkish brown, with many spiracle-sized creamy white spots on disc and irregular ocelli formed by smaller white speckles; vermiculate markings also present on disc; lateral tail base with alternating grey and white stripes; caudal whip greyish to creamy white. Ventral colour white to creamy white, with greyish markings on posterior disc, pelvic fins and tail base.

SIZE. Attains ~65 cm DW (137 cm TL); weighs up to 15 kg, but possibly heavier in Brazilian Amazon. Males mature at ~42 cm DW, females ~50 cm DW (smaller in Ecuador); newborns ~10 cm DW.

HABITAT AND BIOLOGY. South America; upper to lower Amazon River, also in lower Tocantins River. Found mostly in deeper troughs, over muddy or sandy bottoms; not in higher reaches of rivers. Feeds on shrimps, crabs, insects and insect larvae, and fishes (from catfishes to gobies near Amazon delta). Litter size 1–2 pups, gestation 8 months. Important aquarium species.

SIMILAR SPECIES. Differs from the Dwarf Antenna Ray (26.5) in colour, spiracles, snout, nasal curtain, and numbers of teeth and vertebrae.

DWARF ANTENNA RAY

26.5

Plesiotrygon nana Carvalho & Ragno, 2011

NE

IDENTIFICATION. Medium-sized freshwater stingray with a rounded–oval and flat disc (slightly longer than wide in small specimens but just wider than long in adults), head flat, eyes minute and faintly protruding, and dorsal coloration with rosettes, irregular ocelli or reticulate pattern. Snout rounded, short, and with small rostral knob. Head not elevated. Eyes and spiracles close together; eyes small, smaller than spiracles; spiracles rounded–oval (not rhomboidal), and smooth. Nostrils slit-like; nasal curtain posteriorly notched and fringed. Teeth very small, in up to 20 rows in adults. Pelvic fins protrude beyond disc. Tail base width about equal to interorbital distance; distal tail whip-like, very long, nearly 6 times disc length in smaller specimens (some 4 times greater in adults); ventral fold well developed, extending beyond caudal stings. Dorsal disc and tail prickly, with many pointed small denticles; thorns on tail base only moderately developed. Caudal stings elongate and positioned well away from tail base.

COLOUR. Dorsal disc light to dark or blackish brown, with dark reticulate patterns around tan to yellow irregular rosettes, spots and/or incomplete ocelli; pelvic fins with spots or ocelli; tail with grey or brown stripes. Ventral surface creamy white, with dusky grey patches on posterior disc and pelvic fins; tail creamy white to mid-length of tail fold, with alternating darker and lighter bands; posterior tail dark brown.

SIZE. Attains at least 52 cm DW, commonly to 25 cm DW. Males mature at 18–20 cm DW; newborns ~7 cm DW.

HABITAT AND BIOLOGY. South America; Peru, Colombia and Brazil. Present in main channel of upper and central Amazon River, also in smaller tributaries, still water and temporary pools. Exported in ornamental fish trade.

SIMILAR SPECIES. Although classified in the same genus, it has a slightly different coloration and longer tail than the Antenna Ray (26.4).

TAPAJÓS FRESHWATER STINGRAY 26.6

Potamotrygon albimaculata Carvalho, 2016

NE

IDENTIFICATION. Large freshwater stingray with a flat, subcircular disc (slightly longer than wide), small protuberance on central snout, and dorsal surface of disc with small white spots on blackish background. Eyes small, but slightly bulging; spiracles trapezoidal, length at least twice orbit length. Denticles on central disc small, more sparse along disc margins. Nostrils slit-like; nasal curtain skirt-shaped. Mouth small, slightly arched, with 5 oral papillae, and partially covered by nasal curtain; width subequal to internasal distance. Teeth small, in up to 45 rows in jaws. Two angular cartilages between jaw and hyomandibula. Pelvic fins largely covered by disc; no dermal denticles on pelvic fins. Tail broad at base, slender distally, shorter than disc width; with lateral, ventral and dorsal folds. Dorsal tail usually with multiple, more or less regular rows of sharp, moderately tall thorns and numerous sharp thornlets. Caudal stings well developed.

COLOUR. Dorsal disc dark brown to black, covered with numerous round white spots (usually smaller than spiracle) on dorsal disc, pelvic fins and tail base; smaller white specks present on tail and along disc margins; larger spots usually on mid-disc. Ventrally brown to dark brown on disc, pelvic fins and tail; usually only anterior snout and central disc whitish.

SIZE. Attains ~50 cm DW (~75 cm TL). Males mature at ~21 cm DW; born at ~10 cm DW.

HABITAT AND BIOLOGY. South America; mid- to upper Tapajós River basin (only in lower Juruena River), common in Teles Pires River. Litters of usually 2 pups; gestation lasts ~4 months. Feeds on insects and fishes. Although somewhat fragile (mucous covering easily sloughed), this species is commercially exploited.

SIMILAR SPECIES. Resembles other black stingrays such as Xingu (26.16) and Henle's (26.12) Freshwater Stingrays, but different in colour pattern and distribution.

AMANDA'S FRESHWATER STINGRAY 26.7

Potamotrygon amandae Loboda & Carvalho, 2013

NE

IDENTIFICATION. Small freshwater stingray with a subcircular disc (longer than broad), a prickly surface with small denticles on almost entire dorsal disc, dorsal disc usually with bicoloured ocelli, and ventral disc mostly greyish. Eyes large and bulging, smaller than spiracles. Spiracles trapezoidal and large, muscular. Nasal curtain just wider than long; nostrils slit-like. Mouth narrow, with 5 oral papillae and well-developed labial grooves on posterolateral corners. Teeth in up to 37 upper and 33 lower rows in large specimens. A single, robust and anteriorly concave angular cartilage between jaw and hyomandibula. Pelvic fins mostly covered by disc. Tail long and somewhat slender at base; dorsal and ventral folds well developed at tail extremity; tail shorter than disc width. Thorns on dorsal tail in 1–3 rows, generally originating anterior to tail base. Smaller, lateral tail thorns organised in 1–2 rows, usually larger posteriorly. Caudal stings posteriorly positioned on tail.

COLOUR. Dorsally greyish or dark brown, usually with ocelli concentrated on central disc; ocelli with two colours, black peripheral ring and whitish, light grey or light yellow centre; dorsal tail dark with many small spots. Ventrally mostly grey on disc, pelvic fins and tail, with scattered whitish spots.

SIZE. Attains at least 34 cm DW (almost 60 cm TL); matures at 20–30 cm DW. Smallest specimens ~19 cm DW (35 cm TL).

HABITAT AND BIOLOGY. South America; Paraná-Paraguay River, in states of São Paulo and Mato Grosso do Sul (Brazil), at border between Brazil and Paraguay, and near Santa Fé (Argentina). Feeds on invertebrates and fishes. Mostly nocturnal. Individuals may segregate by size with smaller specimens on shallow sandy bottoms, adults in deeper areas in day and shallow waters at night.

SIMILAR SPECIES. Similar to other species in the upper Paraná-Paraguay basin (Pantanal, Ocellate, and Paraná Freshwater Stingrays), mostly differentiated by ventral colour and anatomical details.

SURINAME FRESHWATER STINGRAY 26.8

Potamotrygon boesemani Rosa, Carvalho & Wanderley, 2008

NE

IDENTIFICATION. Medium-sized freshwater stingray with a thick subcircular to oval disc (slightly longer than wide), tail robust with large thorns, and dorsal disc with thickly contoured reddish ocelli. Eyes and spiracles large; spiracles slightly larger than eyes. Mouth and nostrils of similar width; nostrils slit-like, nasal curtain wider than long; mouth with 5 oral papillae. Teeth small, in 45 rows in larger specimens. A pair of angular cartilages between jaw and hyomandibula. Pelvic fins mostly concealed by disc. Tail broad at base, and slightly longer than disc width. Dorsal disc with many small denticles, rough in adults; denticles more concentrated on mid-line and anterior disc region. Dorsal tail with 12–27 median thorns, in 1 irregular row in young specimens, and 28–42 in adults; tail thorns spaced apart, but high, acute and upright. Lateral tail with many sharp thorns in adults. Caudal stings robust, close to dorsal tail base.

COLOUR. Dorsal disc and pelvic fins dark brown with deep orange to red, round to oval ocelli with thick black rings; some ocelli lighter, some fused in pairs mainly on disc centre; ocelli smaller towards disc margins. Inside of mouth with small orange vermiculations; dorsal tail brown, with irregular orange spots. Ventrally creamy white with broad dark brown areas laterally on disc, and with scattered ocellate or vermiculate markings; disc of adults usually with a central dark spot.

SIZE. Attains at least 43 cm DW (~95 cm TL); 38 cm DW adult male recorded, but onset of maturity possibly much smaller.

HABITAT AND BIOLOGY. South America; known only from Corantijn River basin in Suriname (districts of Sipaliwini and Nickerie), and most certainly occurs on the Guyanan side of the same river. Biology largely unknown.

SIMILAR SPECIES. Resembles the Ocellate Freshwater Stingray (26.20), but differs in its differently coloured ocelli with a much thicker outer ring; ventral coloration is also distinct.

GIANT FRESHWATER STINGRAY

26.9

Potamotrygon brachyura (Günther, 1880)

DD

IDENTIFICATION. Very large freshwater stingray with a very large circular disc, a short tail, and dark reticulate dorsal colour pattern. Disc length and width about equal or length slightly greater. Snout broadly rounded anteriorly, and large. Eyes small; spiracles trapezoidal, large, ~2–4 times orbit size. Nostrils slit-like. Mouth small, with 5 or more oral papillae on ventral floor. Teeth large, in up to 37 rows. Distance between nostrils smaller than mouth width. Two angular cartilages between jaw and hyomandibula. Pelvic fins mostly covered by disc. Small, pointed denticles over central region of dorsal disc; disc smoother on margins. Tail not very broad at base, its width at base about half interorbital width. Tail short, tapering after caudal stings, with well-developed ventral fold. Up to 20 small dorsal tail thorns in a single row; adults with well-developed lateral thorns on tail, absent in juveniles. Caudal stings short.

COLOUR. Dorsal surface of disc and tail light brown with dark lines organised in a reticulate pattern, forming polygonal and circular spaces; reticulations delimiting larger spaces on disc centre. Ventrally white, with greyish disc margins and tail; some specimens with a central dark spot on disc.

SIZE. Attains almost 150 cm DW (~200 cm TL), weighs up to 220 kg. Matures at 42–48 cm DW.

HABITAT AND BIOLOGY. South America; Paraná-Paraguay and La Plata basins, and Uruguay River. Frequently seen resting on vegetation in shallow waters. A single litter of 19 embryos has been reported. Feeds on invertebrates (insects, crustaceans) and fishes.

SIMILAR SPECIES. No other species of the genus has a disc as large and circular, and a tail as short, as this species. It also attains a great size, but its colour pattern can be similar to other 'reticulated' species, in particular the Reticulate Freshwater Stingray (26.22) and False Reticulate Freshwater Stingray (26.14).

ROUGH FRESHWATER STINGRAY

26.10

Potamotrygon constellata (Vaillant, 1880)

DD

IDENTIFICATION. Medium-sized freshwater stingray with a thick, oval disc that is slightly longer than wide, rough dorsal surface covered with sharp denticles and larger tubercles on disc margins and tail base, and faintly reticulate dorsal colour pattern. Eyes large and bulging. Spiracles 3–4 times orbit length. Nostril length almost equal to internasal distance; nostrils slit-like. Mouth wider than internasal distance, with 5 oral papillae on ventral floor. Teeth small, in up to 45 rows. Dermal denticles of disc variously sized, slightly greater at disc mid-line. Disc with larger, usually flat but sometimes round-based tubercles at margins, larger than eye diameter, sometimes fused at bases; tubercles sometimes on mid-disc region. Two angular cartilages between jaw and hyomandibula on each side. Pelvic fins covered by disc. Tail wide, depressed at base; dorsal and ventral folds present distally. Tail with a single row of up to 40 tall and sharp thorns; larger, broad-based tubercles also frequently present; lateral tail thorns well developed. Caudal stings long.

COLOUR. Disc greyish brown, with a faded, irregular reticulate pattern and small, whitish spots on disc margins; tail with similar colour, but with white lateral bars. Ventral surface brownish, with white mouth and branchial region.

SIZE. Adult specimens recorded to 43 cm DW.

HABITAT AND BIOLOGY. South America; mid-Amazon River basin, from border of Brazil and Colombia down-river at least to Manaus. Biology and diet largely unknown.

SIMILAR SPECIES. Its colour pattern is similar to the Reticulate Freshwater Stingray (26.22) and False Reticulate Freshwater Stingray (26.14); possibly a synonym of the Reticulate Freshwater Stingray, as its most conspicuous feature (large tubercles on disc margins) is present in specimens of other species.

PARANÁ FRESHWATER STINGRAY

26.11

Potamotrygon falkneri Castex & Maciel, 1963

DD

IDENTIFICATION. Medium-sized freshwater stingray with an oval, slender and compressed disc (just longer than wide), somewhat slender tail with medium-sized thorns, and with small beige to orange spots sometimes forming irregular reticulate and vermiculate patterns. Disc usually with small rostral protuberance. Dorsal disc surface sparsely covered by small denticles, more sparse close to disc margins. Head flat and broad. Eyes small. Spiracle length almost twice eye length. Nostrils slit-like. Nasal curtain posteriorly fringed. Mouth small, with 5 oral papillae on ventral floor. Teeth small, in up to 45 rows. Two angular cartilages between jaw and hyomandibula. Pelvic fins mostly covered by disc. Tail rather slender, shorter than disc width or length, and slightly depressed; 1–3 irregular rows of thorns, more developed near caudal sting base; small denticles close to dorsal tail fold, but absent near ventral fold. Caudal stings slender, distally positioned.

COLOUR. Dorsal surface dark brown, grey or olive brown with circular and oval beige to orange spots, sometimes forming vermiculate patterns and rosettes. Ventrally whitish with peripheral grey spots, or almost entirely grey with white anterior disc region; ventral pelvic fins and tail with dark grey background and some small lighter spots with circular or vermicular patterns.

SIZE. Adults attain 52 cm DW (~89 cm TL). Males mature at ~26 cm DW, females at ~32 cm DW; born at ~14 cm DW.

HABITAT AND BIOLOGY. South America; Paraná-Paraguay and La Plata basins, and upper Amazon River basin in Bolivia, Peru and Brazil. Feeds on insects, molluscs, crustaceans and fishes. Litters of up to 3 pups have been reported.

SIMILAR SPECIES. Dorsal coloration is very similar to Tatiana's Freshwater Stingray (26.29), but they can be distinguished based on tail proportions. The frequently recognised species *P. castexi* Castello & Yagolkowski is a synonym of this species.

HENLE'S FRESHWATER STINGRAY

26.12

Potamotrygon henlei (Castelnau, 1855)

LC

IDENTIFICATION. Large freshwater stingray with a broad subcircular disc, broad and flat teeth in few rows, short and broad tail, and dorsal disc and tail dark and covered with numerous yellowish regular and irregular ocelli. Disc length almost equal to disc width. Central region of dorsal disc with pointed denticles and stellate bases; denticles almost absent on disc margins. Eyes large, bulging. Spiracles small, ~1.5 times greater than orbit length. Nostrils small, slit-like. Mouth large, its width up to 1.5 times internasal distance; 5 oral papillae on ventral floor. Teeth very large, pavement-like, in up to 30 rows. Two angular cartilages between jaw and hyomandibula. Pelvic fins mostly covered by disc. Tail broad at base and short, its length about equal to disc width; dorsal and ventral tail folds low; 15–45 enlarged thorns in 2–3 more or less parallel rows on dorsal tail; lateral tail thornlets developed in adults but lacking in juveniles. Caudal stings large.

COLOUR. Dorsal disc dark, blackish brown or dark grey, with pale yellow or brownish centred ocelli with dark rings; ocelli circular or irregular, larger on disc centre and smaller near its margins; dorsal and lateral tail with ocelli. Ventral disc whitish with brownish disc margins; ventral tail with small white irregular spots.

SIZE. Attains ~72 cm DW (~105 cm TL). Females mature at ~48 cm DW (80 cm TL), males at smaller sizes; born at ~25 cm DW.

HABITAT AND BIOLOGY. South America; lower Tocantins River (but only below confluence with Araguaia River) and in Araguaia River. Feeds on insects, molluscs (preys heavily on gastropods), and small fishes. Litters of 1–9 pups with number of pups increasing with maternal size. Important aquarium species.

SIMILAR SPECIES. Most similar to the Xingu Freshwater Stingray (26.16), but differs in dentition and disposition of dorsal thorns on tail.

PORCUPINE FRESHWATER STINGRAY 26.13

Potamotrygon histrix (Müller & Henle, 1836)

DD

IDENTIFICATION. Small to medium-sized freshwater stingray with an oval, longer than wide disc, skin very prickly with numerous small denticles on disc, disc margins and tail, and grey to brown dorsal coloration with irregular vermiculate pattern and predominantly grey ventral surface. Eyes and spiracles large; spiracles almost 4 times orbit length. Nostrils slit-like, their length greater than internasal distance. Mouth large, about as wide as internasal distance; 5 oral papillae on ventral floor. Teeth small, in up to 42 rows. A single, elongated angular cartilage between jaw and hyomandibula. Pelvic fins covered by disc. Tail broad at base, slightly longer than disc width, and usually with well-developed dorsal and ventral folds near tip. Dorsal tail thorns in 2–3 irregular rows, with up to 70 enlarged acute thorns, interspersed with smaller denticles; many sharp, smaller thornlets also present on lateral tail. Caudal stings well developed.

COLOUR. Dorsal disc greyish, greenish brown or dark brown, with sparse, small white spots on disc margins, and a slender, faint vermicular pattern on central disc; spots sometimes resembling tear-drops. Ventrally greyish white with darker margins, or almost entirely dark grey except for ventral branchial and/or oral region.

SIZE. Attains ~40 cm DW, commonly smaller; matures at ~25 cm DW.

HABITAT AND BIOLOGY. South America; confined to Paraná-Paraguay basin. Produces litters of up to 9 pups. Feeds on insects, crustaceans and fishes. Biology little known.

SIMILAR SPECIES. Resembles the Rosette Freshwater Stingray (26.26) in general shape, overall colour and having a very prickly skin, but lacks its typical rosette-like dorsal disc markings and has a more prickly lateral tail. Also similar to Amanda's Freshwater Stingray (26.7), and less so to the Pantanal Freshwater Stingray (26.23), in ventral colour but its dorsal coloration is distinctive.

FALSE RETICULATE FRESHWATER STINGRAY 26.14

Potamotrygon humerosa Garman, 1913

NE

IDENTIFICATION. Small freshwater stingray with a flat subcircular disc (slightly longer than wide), small protuberance on central snout, disc and tail prickly, and dorsal surface of disc with reticulate colour pattern. Eyes small and slightly bulging; spiracles trapezoidal, about twice orbit length. Denticles on central disc small, more sparse on disc margins. Nostrils slit-like; nasal curtain trapezoidal. Mouth small, lightly arched, with 5 oral papillae, and partially covered by nasal curtain; width subequal to internasal distance. Teeth small, in up to 46 upper and 49 lower rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins covered by disc; no dermal denticles on pelvic fins. Tail small and slender, shorter than disc width, with distinct ventral and dorsal folds, and compressed laterally at origin of caudal stings; dorsal fold with numerous small denticles. Dorsal tail usually with single row of sharp thorns and numerous, sharp lateral tail thornlets. Caudal stings well developed.

COLOUR. Dorsal disc dark brown, with dark beige circular spaces delimited by a slender reticulate pattern; dorsal tail also with paired circular spots creating dark and light stripes. Ventrally whitish on central disc with some grey spots, and grey on disc margins.

SIZE. Attains 33 cm DW (~57 cm TL). Males mature at ~21 cm DW, females at ~23 cm DW; born at ~10 cm DW.

HABITAT AND BIOLOGY. South America; upper to lower parts of Amazon River basin. Litter size up to 3, but usually fewer; gestation 3–4 months; both uteri functional. Feeds on insects and fishes.

SIMILAR SPECIES. Similar to 3 other 'reticulated' species, the Reticulate Freshwater Stingray (26.22), French Guiana Freshwater Stingray (26.19) and Giant Freshwater Stingray (26.9) in dorsal coloration, but differs in its reproductive biology, denticle patterns (more prickly), tail proportions and several other anatomical features.

PEARL FRESHWATER STINGRAY 26.15

Potamotrygon jabuti Carvalho, 2016

NE

IDENTIFICATION. Large freshwater stingray with a subcircular disc (longer than wide), small protuberance on central snout, disc and tail moderately prickly, and dorsal disc with elaborate pattern of golden spots and broad ocelli. Eyes bulging; spiracles trapezoidal, about twice orbit size. Denticles on central disc small to medium-sized, sparser along disc margins. Nostrils slit-like; nasal curtain trapezoidal. Mouth small, slightly arched, with 5 oral papillae, and partially covered by nasal curtain; width subequal to internasal distance. Teeth small, in up to 50 rows. Two angular cartilages between jaw and hyomandibula. Pelvic fins mostly covered by disc; no dermal denticles on pelvic fins. Tail broad, robust at base, usually shorter than disc in adults; with distinct lateral, ventral and dorsal folds at tip. Dorsal tail usually with single irregular row of tall, sharp thorns and numerous sharp thornlets in larger specimens. Caudal stings well developed.

COLOUR. Dorsal disc greyish brown, grey to greenish black, with highly variable ornate pattern composed of yellow or golden spots grouped within larger, golden irregular outlines forming large ocelli; brain-shaped figures and larger spots also present; disc margins with smaller spots and ocelli. Ventrally whitish on central disc with darker disc margins, pelvic fins and tail; yellow spots forming vermiculate pattern on tail and central spot on ventral disc.

SIZE. Attains ~48 cm DW (~75 cm TL). Matures at ~23 cm DW; born ~10 cm DW.

HABITAT AND BIOLOGY. South America; mid- to upper Tapajós River basin (not in mid- to upper Juruena River), common in Teles Pires River. Litter size usually 2–3; gestation ~4 months. Feeds on insects and fishes. A hardy, commercially exploited aquarium species.

SIMILAR SPECIES. Distinctive, very ornate species, similar to Ocellate Freshwater Stingray (26.20) in proportions, but they have very different colour patterns.

XINGU FRESHWATER STINGRAY

26.16

Potamotrygon leopoldi Castex & Castello, 1970

DD

IDENTIFICATION. Large freshwater stingray with a thick, subcircular disc (slightly longer than wide), teeth pointed and not arranged in pavement-like pattern, tail robust with parallel rows of thorns, and disc and tail blackish brown with yellowish ocelli. Dermal denticles covering most of disc surface, larger and more developed on disc centre. Eyes large, bulging. Spiracles trapezoidal, muscular, obliquely positioned, and length ~3 times orbit length. Nostrils slit-like; nasal curtain trapezoidal. Mouth slightly larger than internasal width, with 5 oral papillae on mouth floor. Teeth small, in up to 35 upper and 39 lower rows. Two angular cartilages of similar size between jaw and hyomandibula. Pelvic fins covered by disc. Tail slightly shorter than disc width, broad based, muscular, laterally compressed near caudal stings, with well-developed dorsal and ventral folds; 3 roughly parallel rows of numerous enlarged, tall and sharp dorsal tail thorns; small denticles and thorns on lateral tail moderately developed, located near origin of caudal stings. Caudal stings robust.

COLOUR. Dorsal disc dark greyish to black, with yellow ocelli with dark or lighter centres; ocelli small and circular near disc margins, and larger, more oval to irregular on central disc; small yellowish to white spots frequently on head region; tail with small ocelli. Ventrally mostly dark with small white spots on disc margins; white on anterior snout, and around mouth and gills.

SIZE. Attains ~72 cm DW (95 cm TL), possibly larger; males mature at ~40 cm DW.

HABITAT AND BIOLOGY. South America; endemic to Xingu River, in Pará and Mato Grosso states (Brazil). Produces litters of 4–12 pups, usually 7–8. Common on rocky bottoms, where it feeds mostly on gastropods and crabs. Important aquarium species.

SIMILAR SPECIES. Resembles Henle's Freshwater Stingray (26.12), but it differs in dentition (teeth more numerous and smaller), and rows of tail thorns (also more numerous).

MADEIRA FRESHWATER STINGRAY

26.17

Potamotrygon limai Fontenelle, Silva & Carvalho, 2014

NE

IDENTIFICATION. Medium-sized to large freshwater stingray with an oval disc (slightly longer than wide), small rostral protuberance at anterior disc margin, 3 angular cartilages in jaw, and dorsal surface coloration elaborate with light spots forming honeycomb-like patterns. Disc margins much thinner than disc centre. Dorsal surface covered with numerous small denticles. Eyes small, slightly bulging. Spiracles more than twice orbit length. Nostrils slit-like; nasal curtain trapezoidal, with a posterior fringe, partially covering mouth. Mouth small, without labial folds, and with 5 oral papillae on mouth floor. Teeth small, in up to 48 rows. A pair of medium-sized angular cartilages, as well as smaller lateral angular cartilage, between jaw and hyomandibula. Pelvic fins wide, slightly exposed posteriorly. Tail elongate, not very broad, just shorter than disc width, tapering only slightly to level of caudal stings; dorsal and ventral folds low; enlarged dorsal thorns in 2–3 rows anteriorly, but in a single row posteriorly; dorsal thorns low, broadly triangular. Caudal stings well developed.

COLOUR. Dorsally brownish to greenish brown, with small whitish or brownish spots in honeycomb-like pattern, producing reticulate effect; irregular whitish spots present on disc margin. Ventrally whitish with dark posterior and lateral disc margins; posterior pelvic fins and tail darker, covered by dark spots.

SIZE. Attains at least 65 cm DW (91 cm TL).

HABITAT AND BIOLOGY. South America; Jamari River, upper Madeira River basin, in state of Rondônia (Brazil); may occur elsewhere. Biology and diet largely unknown.

SIMILAR SPECIES. Resembles the Reticulate Freshwater Stingray (26.22) in having a reticulate dorsal coloration, but aspects of its pattern are distinct (darker dorsally) and differs in anatomical features (e.g. number of angular cartilages).

MAGDALENA FRESHWATER STINGRAY 26.18

Potamotrygon magdalenae (Valenciennes, 1865)

NT

IDENTIFICATION. Medium-sized freshwater stingray with a thin, oval disc (clearly longer than wide), long tail with few thorns, and dorsal disc covered with numerous, small yellowish spots. Anterior snout with a small protrusion. Dorsal surface mostly smooth, with very small denticles on central and anterior disc. Eyes small. Spiracles broad and muscular, 2–3 times larger than orbit length. Nostrils small, slit-like; nasal curtain slender, skirt-shaped. Mouth small and curved, with 5 oral papillae on mouth floor; mouth width slightly greater than internasal space. Teeth small, in up to 39 upper and 36 lower rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins with wide anterior margin and subacute apices, covered by disc; claspers large. Tail long, usually longer than disc width, not very broad at base, and more slender than interorbital space; dorsal and ventral folds well developed, dorsal fold slightly greater than ventral; enlarged tail thorns few, in a single row; lateral tail thornlets few and small. Caudal stings elongate.

COLOUR. Dorsally light to dark brown or greyish brown, with many irregular, small brown to yellow spots, smaller on mid-disc and tail, and larger on disc margins (larger specimens); spots sometimes delimiting darker, slender and faded reticulate pattern; spots or reticulate pattern sometimes missing from interorbital region. Ventrally white; disc margins greyish with white spots.

SIZE. Attains 47 cm DW, males smaller. Males mature at 13–17 cm DW, females at 17–21 cm DW; young born at ~9 cm DW.

HABITAT AND BIOLOGY. South America; Magdalena and Atrato rivers of northern Colombia. Feeds mostly on insects, but also other invertebrates and fishes. Produces litters of usually a single pup per uterus. Among smallest species of genus *Potamotrygon*; important in the aquarium trade.

SIMILAR SPECIES. Easily distinguishable from other related species by its smaller size, distinctive colour pattern and restricted distribution.

FRENCH GUIANA FRESHWATER STINGRAY 26.19

Potamotrygon marinae Deynat, 2006

DD

IDENTIFICATION. Medium-sized freshwater stingray with a thick, oval disc (slightly longer than wide), small protuberance on central snout, single irregular row of tail thorns, and irregular reticulate colour pattern formed by yellow to orange blotches composed of small spots. Snout region anterior to eyes very large. Eyes small, slightly bulging. Spiracles larger than eyes, trapezoidal and muscular. Nostrils slit-like; nasal curtain trapezoidal and posteriorly fringed; distance between nostrils smaller than outer corners of mouth. Mouth small, with 5 oral papillae on ventral floor; well-developed labial grooves at lower jaw corners. Teeth small, with flat crowns in 34 upper and 47 lower rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins covered by disc. Tail shorter than disc width or length, slightly depressed at base, but laterally compressed posteriorly at level of caudal stings; dorsal and ventral folds present; dorsal tail thorns few and low, in a single irregular row, originating at level of pectoral disc insertions. Caudal stings well developed.

COLOUR. Dorsal disc dark brown to black, with yellow, brown or orange blotches, as large as interorbital space, and formed by small spots, delimiting an irregular reticulate pattern; pelvic fins also with vermiculate pattern of smaller spots; dorsal tail with lateral stripes. Ventral surface of disc, pelvic fins and tail mostly dark grey, covered with beige spots forming vermiculate patterns; anterior ventral snout to first gill slit whitish.

SIZE. Attains at least 42 cm DW (65 cm TL). Females probably mature at ~30 cm DW, males at ~24 cm DW.

HABITAT AND BIOLOGY. South America; confined to French Guiana (e.g. Oyapoc, Maroni, Inini and Tampoc rivers) and Suriname (Lawa River). Biology and diet unknown.

SIMILAR SPECIES. Similar to other 'reticulated' species, but with unique colour pattern, a much greater preorbital snout length, and broader tail at base.

OCELLATE FRESHWATER STINGRAY

26.20

Potamotrygon motoro (Müller & Henle, 1841)

DD

IDENTIFICATION. Medium-sized freshwater stingray with a thick disc (longer than wide), no protuberance on snout, broad interorbital region, tall tail thorns, and dorsal colour pattern with ocelli consisting of 3 colours. Star-shaped denticles covering dorsal disc, more concentrated on central disc; smaller denticles on disc margins. Head very broad. Eyes bulging. Spiracles large, trapezoidal, muscular. Nostrils slit-like; nasal curtain trapezoidal. Mouth broad, with 5 oral papillae; labial grooves absent. Teeth large, arranged in up to 32 upper and 34 lower rows, with tooth shape variable along upper jaw in adults. Two equal-sized angular cartilages between jaw and hyomandibula. Pelvic fins generally covered by disc. Tail broad based, short, shorter than disc width; dorsal and ventral folds low in adults; dorsal tail with a single row of tall, upright pointed thorns, originating near disc insertion and ending at level of caudal sting origin. Lateral tail thornlets low, in an irregular row. Caudal stings well developed.

COLOUR. Dorsal disc grey to brown, with conspicuous tri-coloured ocelli with a yellowish central spot, intermediate orange ring and external black ring over entire disc to tail base. Ventral disc creamy white to light yellow with dark grey or light brown disc margins, sometimes with small dark spots.

SIZE. Attains at least 48 cm DW (77 cm TL). Matures at ~25 cm DW; born at just under 10 cm DW.

HABITAT AND BIOLOGY. South America; most widespread neotropical freshwater stingray, found in Paraná-Paraguay, Amazon, and Orinoco basins, and elsewhere. Feeds on insects (especially flies and mayflies), crustaceans and small fishes; diet geographically and seasonally variable. Produces litters of up to 11 pups (usually 2–4), but also locally variable. Important in the aquarium trade.

SIMILAR SPECIES. Similar to other 'ocellated' species, e.g. Amanda's Freshwater Stingray (26.7) and Pantanal Freshwater Stingray (26.23), but with a wider head and uniquely coloured ocelli.

MARAJÓ FRESHWATER STINGRAY

26.21

Potamotrygon ocellata (Engelhardt, 1912)

DD

IDENTIFICATION. Possibly medium-sized freshwater stingray with an almost circular disc (width and length almost equal), few tooth rows, sparse and low dorsal tail thorns, and dorsal surface a rusty brown colour covered with orange ocelli. Eyes large. Spiracles almost twice orbit length. Nostrils almost as long as internasal distance; nasal curtain small, trapezoidal. Mouth large, its width just greater than internasal distance; 5 oral papillae on floor. Teeth rather large, in few rows (up to 25 in known specimen). Two angular cartilages between jaw and hyomandibula. Pelvic fins covered by disc. Tail about as long as disc width, moderately wide at base; a single row of few and low enlarged dorsal thorns; small lateral thornlets also present on tail. Caudal stings moderately developed.

COLOUR. Dorsal coloration brown to rusty brown, with orange ocelli surrounded by darker rings; ocelli larger on central disc, smaller at margins. Ventrally white with brown disc margins and small orange to yellow spots.

SIZE. Poorly known, based on juvenile female specimen 19 cm DW (30 cm TL).

HABITAT AND BIOLOGY. South America; lower Amazon River near its mouth in Pará and Amapá states, Brazil. Biology and diet unknown.

SIMILAR SPECIES. Similar to the Ocellate Freshwater Stingray (26.20) and Suriname Freshwater Stingray (26.8), distinguished principally by its fewer larger teeth; this poorly defined species may be a synonym of the Ocellate Freshwater Stingray.

RETICULATE FRESHWATER STINGRAY 26.22

Potamotrygon orbignyi (Castelnau, 1855)

LC

IDENTIFICATION. Medium-sized freshwater stingray with an oval disc (slightly longer than wide), small protuberance on central snout, clearly demarcated grooves around mouth, and dorsal colour pattern usually reticulated. Eyes slightly bulging, large. Spiracles about twice orbit length, trapezoidal and muscular. Dorsal central disc with small denticles, these smaller and sparser on disc margins. Nostrils slit-like; nasal curtain with posterior fringes. Mouth small, with 5 oral papillae; short labial grooves present at lower jaw corners. Teeth small, in up to 45 rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins covered by disc. Tail broad at base and long, almost as long as disc, and usually with well-developed dorsal and ventral folds; posterior portion of tail laterally compressed; enlarged thorns on dorsal tail usually in a single regular row. Caudal stings large.

COLOUR. Dorsal coloration brown or light brown, with a darker reticulate pattern, sometimes with small kidney-shaped dark brown spots on central disc, smaller toward margins; pelvic fins with same pattern as dorsal disc but with more circular spots; dorsal tail with whitish stripes. Ventral disc mostly white at centre and darker grey at margins, sometimes with grey circular spots; dark oval blotch between 5th gill slits.

SIZE. Attains 61 cm DW (~110 cm TL); males mature at ~25 cm DW, females slightly larger; born at ~11 cm DW.

HABITAT AND BIOLOGY. South America; widespread in Amazon and Orinoco basins, and also in rivers of Guyana, Suriname, and French Guiana. Diel migrations observed for adults, which seek deeper waters during the day and move closer to shore at night. Feeds on crustaceans, insects, and fishes. Litters of usually 2 pups. Important aquarium species.

SIMILAR SPECIES. Similar to other 'reticulate' freshwater stingrays, but different in disc and tail proportions, denticles, vertebral numbers, and in colour pattern specifics; most similar to False Reticulate Freshwater Stingray (26.14).

PANTANAL FRESHWATER STINGRAY 26.23

Potamotrygon pantanensis Loboda & Carvalho, 2013

NE

IDENTIFICATION. Small freshwater stingray with an oval, longer than wide disc, lacking knob-like protuberance on central snout, with bicolored ocelli dorsally, and mostly greyish ventral coloration. Eyes large and bulging. Spiracles slightly larger than orbits, trapezoidal and muscular. Dermal denticles of dorsal disc more concentrated in central area; disc margins with few and smaller denticles. Ventral mouth floor with 5 oral papillae. Labial grooves present at lower jaw corners. Teeth very small, with uniform morphology along jaw, arranged in up to 35 upper and 31 lower rows. A single well-developed angular cartilage between jaw and hyomandibula. Pelvic fins mostly covered by disc. Tail short, broad, shorter than disc width; dorsal and ventral folds present; 2–3 irregular rows of rather small, slender and curved thorns on dorsal tail; a single lateral row of small thornlets originating on tail base and extending to origin of caudal sting. Caudal stings moderately developed.

COLOUR. Dorsal disc brown, covered by bicolored ocelli and/or a vermiculate pattern, both with yellow, orange or beige centres surrounded by a black ring; ocelli about equal to orbit length or smaller. Ventral disc mostly grey, with white anterior snout and branchial region; ventral tip of tail black with some lighter spots.

SIZE. Attains 34 cm DW (~66 cm TL).

HABITAT AND BIOLOGY. South America; known from Cuiabá River in Pantanal region, state of Mato Grosso do Sul (Brazil). Biology and diet largely unknown.

SIMILAR SPECIES. Most similar to Amanda's Freshwater Stingray (26.7) and the Ocellate Freshwater Stingray (26.20), but differs in aspects of its colour pattern, a shorter and broader tail with less developed dorsal and ventral folds, and in having a more uniform dentition.

GREAT FRESHWATER STINGRAY

26.24

Potamotrygon rex Carvalho, 2016

NE

IDENTIFICATION. Very large freshwater stingray with a thick, broad subcircular disc, short and broad tail, and upper disc and tail dark brown to black, covered with numerous yellow or orange spots forming rosette-like patterns. Disc length slightly exceeding disc width. Central region of dorsal disc with flat denticles; denticles almost absent on disc margins. Eyes large, bulging. Spiracles very large, rhomboidal, ~1.5 times greater than orbit length. Nostrils small, slit-like. Mouth small, about as wide as internasal distance; 5 oral papillae on mouth floor. Teeth numerous, small, in up to 45 rows. Two angular cartilages between jaw and hyomandibula. Pelvic fins mostly covered by disc. Tail very broad at base in adults; short, its length usually less than disc width in adults; lateral folds well developed; dorsal and ventral folds low; tall, sharp thorns in usually a single or double irregular row on dorsal tail; lateral tail thornlets developed in adults but lacking in juveniles. Caudal stings well developed.

COLOUR. Dorsal colour variable, usually blackish brown covered with many small rounded, yellow to orange spots arranged in groups with larger spots at their centre; large and small isolated spots or ocelli on disc periphery and on dorsal and lateral tail. Ventral disc and pelvic fins mostly dark grey with white spots; gill area usually white. Tail dark brown with yellowish blotches.

SIZE. Attains ~70 cm DW (~110 cm TL); largest females weigh ~20 kg. Females mature at ~45 cm DW (80 cm TL), males at smaller sizes; born at ~25 cm DW.

HABITAT AND BIOLOGY. South America; mid- to upper Tocantins River (upriver of confluence with Araguaia River). Probably feeds on insects, molluscs, and small fishes.

SIMILAR SPECIES. Most similar to Henle's Freshwater Stingray (26.12), but differs in dentition, pattern of dorsal thorns on tail, and dorsal and ventral coloration.

SCHROEDER'S FRESHWATER STINGRAY 26.25

Potamotrygon schroederi Fernandez-Yépez, 1958

DD

IDENTIFICATION. Medium-sized freshwater stingray with an oval, longer than wide disc, small rostral protuberance in small specimens, broad tail, and unique dorsal colour pattern of yellow spots and rosettes delimiting brain-like patterns. Head slender. Denticles on dorsal disc small, concentrated on central disc, and smaller and sparser on disc margins. Eyes small, bulging. Spiracles broad, rhomboidal, obliquely positioned and much larger than eyes. Nostrils slit-like; nasal curtain trapezoidal, with a fringed posterior margin. Mouth small, straight; 5 oral papillae on ventral mouth; no labial folds. Teeth small, in up to 49 upper and 60 lower rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins mostly covered by disc. Tail broad, its width about equal to interorbital space, and not very long, shorter than disc width; dorsal and ventral folds ridge-like in adults; lateral fold extends to level of caudal sting; enlarged dorsal tail thorns low, in 1–4 irregular rows originating anterior to level of disc insertion; lateral tail thornlets numerous posteriorly. Caudal stings well developed.

COLOUR. Dorsal colour greyish brown or greenish brown to dark brown, with beige or golden yellow rosettes and brain-shaped figures on central disc, and smaller, lighter spots on disc margins; pelvic fins similar to disc; dorsal tail with alternating darker and lighter bars. Ventral disc and pelvic fins uniform whitish, sometimes darker at margins.

SIZE. Attains at least 44 cm DW (~75 cm TL), but reaches greater sizes. Males mature by 40 cm DW, but probably mature at smaller sizes; born at ~14 cm DW.

HABITAT AND BIOLOGY. South America; found in upper Negro River (Brazil) and mid- to upper Orinoco River (Venezuela). Produces litters of 1–3 pups. Feeds on insects, crustaceans and fishes. Exported from Manaus for the aquarium trade.

SIMILAR SPECIES. Most similar to the Tiger Freshwater Stingray (26.30), but with a distinct dorsal colour pattern.

ROSETTE FRESHWATER STINGRAY 26.26

Potamotrygon schuhmacheri Castex, 1964

DD

IDENTIFICATION. Small freshwater stingray with a subcircular, slightly longer than wide disc, prickly dorsal surface covered with many small denticles (largest on mid-disc and smallest at disc margins), and greenish to brownish dorsal coloration covered with lighter, irregular rosettes. Eyes large, ~2 times in interorbital distance. Spiracles about twice orbit length, trapezoidal. Nostrils and nasal curtain small. Mouth small, about same size as internasal space, with 5 oral papillae on ventral floor. Teeth small in up to 30 rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins covered by disc. Tail short, shorter than disc, with a single, irregular row of enlarged mid-row thorns; tail prickly, also with many smaller thornlets on dorsal tail. Caudal stings well developed.

COLOUR. Dorsal surface brown, dark greyish brown or greenish brown, with dark, irregular, ocelli-like spots with dark centres surrounded by lighter outlines, forming rosette-like markings on dorsal disc; spots smaller and more circular on disc margins. Ventral surface of disc and pelvic fins with a greyish background, with many white spots.

SIZE. Attains at least 35 cm DW (~45 cm TL); a male mature at 24 cm DW (35 cm TL).

HABITAT AND BIOLOGY. South America; known from Paraná-Paraguay river basin. Biology and diet largely unknown.

SIMILAR SPECIES. Very similar to the Porcupine Freshwater Stingray (26.13), and presently distinguished by the rosette pattern on the dorsal disc, lacking well-developed lateral tail thorns, and by slight differences in clasper skeleton and pectoral-fin radial counts. Known from few specimens and may eventually prove to be a synonym of the Porcupine Freshwater Stingray.

WHITESPOTTED FRESHWATER STINGRAY 26.27

Potamotrygon scobina Garman, 1913

DD

IDENTIFICATION. Medium-sized freshwater stingray with a subcircular to oval disc (slightly longer than wide), with small knob on anterior snout, long tail usually with single row of thorns, and dorsal coloration with many small yellow spots. Disc at margins flat and slender. Dorsal surface with denticles concentrated on anterior disc, smaller on margins. Eyes small. Spiracles broad and trapezoidal, about twice orbit length in size. Nostrils slit-like; nasal curtain fringed posteriorly. Mouth small, with 5 oral papillae on mouth floor. Teeth small, in up to 44 upper and 50 lower rows. Two medium-sized and 1 smaller angular cartilage between jaw and hyomandibula. Pelvic fins broad. Tail long, slender, longer than disc length, its width about 1/2 of interorbital space; tail posterior to caudal stings long. Dorsal tail with a single irregular row of low, pointed, broad-based and triangular thorns, with smaller denticles among taller thorns; dorsal and ventral folds well developed. Caudal stings large.

COLOUR. Dorsal colour light to dark brown, covered with white to yellow, round, small (eye-length) spots on disc and tail; tail with small vermiculate spots and sometimes dark reticulate pattern; spots on disc smaller at margins. Ventrally creamy white, with darker lateral and posterior disc margins, posterior pelvic fins and ventral tail; creamy white areas sometimes with small greyish spots.

SIZE. Attains 66 cm DW (~135 cm TL); size at maturity variable, but usually at ~25 cm DW in males.

HABITAT AND BIOLOGY. South America; widely distributed from upper to lower Amazon River basin, and present in many of its major tributaries (e.g. Tocantins, Pará, and Trombetas rivers in Brazil, upper Orinoco River in Colombia). Feeds on crustaceans and small fishes. Litters of up to 4 embryos.

SIMILAR SPECIES. Similar in body proportions to the Madeira Freshwater Stingray (26.17) and other species of the *scobina*-complex (all species have 3 angular cartilages), but differs in its colour pattern.

PARNAÍBA FRESHWATER STINGRAY 26.28

Potamotrygon signata Garman, 1913

DD

IDENTIFICATION. Medium-sized freshwater stingray with an oval, longer than wide disc, small knob at anterior disc margin, and dorsal disc greenish brown and covered with numerous minute, yellowish spots forming vermiculate patterns. Dorsal surface prickly, covered with many small dermal denticles, larger on disc centre. Head broad. Eyes small. Spiracles about twice orbit length. Nostrils slit-like and short, their length ~1.5–2 times internasal distance; nasal curtain broad, trapezoidal. Mouth large, its width about equal to internasal distance, with 5 oral papillae on mouth floor. Teeth small, in some 36 rows in medium-sized individuals. A single very broad angular cartilage between jaw and hyomandibula. Pelvic fins mostly concealed by disc. Tail broad at base and short, shorter than disc width, with enlarged, pointed thorns in 2–3 irregular rows; smaller thornlets also on lateral tail near caudal stings. Caudal stings long.

COLOUR. Disc dark to greenish brown, with numerous small (smaller than orbit length) and irregular yellowish spots, sometimes forming a clear vermiculate pattern on mid-disc; spots smaller closer to disc margins; larger specimens with spots grouped into rosettes. Ventral disc white with darker posterior margins, also on pelvic fins; ventral tail mottled with yellow spots on dark background.

SIZE. Attains at least 45 cm DW (~75 cm TL); males mature by 30 cm DW.

HABITAT AND BIOLOGY. South America; endemic to Parnaíba River basin, Piauí and Ceará states, Brazil. Feeds on insects, crustaceans, molluscs and small fishes, but prefers flies (Diptera) and mayflies (Ephemeroptera); diet shifts with growth. Biology largely unknown.

SIMILAR SPECIES. Resembles other 'small-spotted' species, e.g. the Whitespotted Freshwater Stingray (26.27), but has a slightly different dorsal colour pattern, more rows of tail thorns, and a different angular cartilage morphology.

TATIANA'S FRESHWATER STINGRAY 26.29

Potamotrygon tatianae Silva & Carvalho, 2011

NE

IDENTIFICATION. Small freshwater stingray with a very thin, oval disc (longer than wide), elongate tail with single row of thorns, and dorsal surface with closely set brown spots. Anterior snout with small rostral protuberance. Eyes small, slightly bulging. Spiracles trapezoidal, obliquely positioned, and 2–3 times orbit length. Dorsal surface covered with small denticles, more on mid-disc; denticles smaller and more sparse on peripheral disc, almost absent from disc margins. Nostrils slit-like; nasal curtain small, trapezoidal. Mouth small, with 5 oral papillae on floor. Teeth small, in up to 46 rows. Two equal-sized angular cartilages between jaw and hyomandibula. Pelvic fins without denticles and partially covered by disc. Tail elongate, much longer than disc width, dorsoventrally depressed at base, laterally compressed at level of caudal stings; width at tail base almost equal to interorbital space; dorsal and ventral folds present, with small denticles on dorsal fold; enlarged tail thorns in single irregular row from tail base to caudal stings; small denticles on lateral tail from sting base to tail end. Caudal stings moderately developed.

COLOUR. Dorsal colour olive brown to blackish brown, with numerous small, tightly packed light brownish spots forming vermiculate pattern. Ventrally mostly white, with greyish disc margins and small central grey spots; ventral tail grey with a few lateral vermicular white spots.

SIZE. Attains 36 cm DW (~75 cm TL); males mature at ~30 cm DW.

HABITAT AND BIOLOGY. South America; found only in Madre de Díos River, upper Madeira River basin, Peru. Feeds on small fishes. Biology largely unknown.

SIMILAR SPECIES. Very similar to the Paraná Freshwater Stingray (26.11), but has a significantly longer tail, and different dentition and tail thorn pattern.

TIGER FRESHWATER STINGRAY 26.30

Potamotrygon tigrina Carvalho, Sabaj-Perez & Lovejoy, 2011

NE

IDENTIFICATION. Large freshwater stingray with an oval, slightly longer than wide disc, small knob-like protuberance on anterior snout in smaller specimens, and dorsal colour pattern with numerous conspicuous vermiculate and reticulate yellow markings. Presence of dermal denticles in variable sizes on the central region with the larger denticles at the mid-line of dorsal disc, smaller closer to the margins. Denticles absent on margins of disc. Eyes small, slightly bulging. Spiracles rhomboidal, much larger than eyes, obliquely positioned. Nostrils short, slit-like; nasal curtain with fringed posterior margin, trapezoidal. Mouth small, but its width greater than internasal distance; 5 oral papillae on mouth floor; no labial folds. Teeth small, in up to at least 42 upper and 46 lower rows. A single angular cartilage between jaw and hyomandibula. Pelvic fins mostly covered by disc in dorsal view. Tail long and not very broad based, longer than disc length, with well-developed dorsal and ventral folds; slender lateral folds originate at tail base and extend to level of caudal stings; enlarged dorsal thorns on tail low, in 1–2 irregular rows. Caudal stings robust.

COLOUR. Dorsal disc brown, usually darker at mid-disc and lighter at margins, with yellowish vermiculate markings forming an irregular reticulate pattern, these more slender closer to disc periphery; small creamy white spots on disc margins; dorsal tail with a contrasted pattern of dark and creamy bars. Ventrally mostly creamy white.

SIZE. Possibly to 70 cm DW; males probably mature ~40 cm DW.

HABITAT AND BIOLOGY. South America; known from Nanay River, an Amazon River tributary near Iquitos (Peru). Biology unknown. Important aquarium species.

SIMILAR SPECIES. Similar to Schroeder's Freshwater Stingray (26.25) in having broad, alternating stripes on the tail, but differs in other aspects of its dorsal colour.

WALLACE'S FRESHWATER STINGRAY 26.31

Potamotrygon wallacei Carvalho, Rosa & Araújo, 2016

NE

IDENTIFICATION. Small freshwater stingray with an oval disc (slightly longer than wide), small protuberance on anterior snout, and dorsal colour pattern with vermiculate and brain-shaped markings. Dermal denticles small, not numerous, more concentrated on disc mid-line. Eyes slightly bulging. Spiracles rhomboidal, larger than eyes, and obliquely positioned. Nostrils short, slit-like; nasal curtain with fringed posterior margin, trapezoidal. Mouth small, but wider than internasal distance; 5 oral papillae on mouth floor; no labial folds. Teeth small, in up to at least 52 upper and lower rows in jaws; adult males with enlarged cusps. A single angular cartilage between jaw and hyomandibula. Pelvic fins broad, mostly covered by disc in dorsal view. Tail short, about equal to or just longer than disc width; tail with tall dorsal and ventral folds, and slender lateral folds extending from tail base to level of caudal stings. Dorsal tail thorns blunt, usually in a single irregular row. Caudal stings slender.

COLOUR. Dorsal disc light brown, with conspicuous irregular blackish, broad vermiculations delimiting brain-shaped figures and smaller circular spots and kidney-shaped markings toward disc margins. Tail with dark brown lateral bands. Ventrally white, with dark brown margins on disc and pelvic fins; tail underside mottled light and dark brown.

SIZE. Attains ~27 cm DW (~44 cm TL). Matures at 16–19 cm DW in males and females; born at 6–10 cm DW.

HABITAT AND BIOLOGY. South America; known only from upper Negro River (northern Brazil). Fecundity from 1–5 embryos (usually 2) per litter; gestation ~3 months. Important aquarium species.

SIMILAR SPECIES. Resembles the larger Reticulate Freshwater Stingray (26.22) in being pale brown with darker brown or blackish markings, but lacking its fine reticulations.

MARACAIBO FRESHWATER STINGRAY 26.32

Potamotrygon yepezi Castex & Castello, 1970

DD

IDENTIFICATION. Medium-sized freshwater stingray with an oval, slightly longer than wide disc, small knob-like projection on anterior snout, long tail, and unique dorsal colour pattern formed by irregular blackish speckles on paler grey background in adults. Dorsal disc mostly smooth, with few sparse and small denticles on mid-line. Eyes large, bulging. Spiracles rather small, only ~1–2 times orbit length. Nostrils slit-like, nasal curtain trapezoidal. Mouth large, just wider than internasal distance; 5 oral papillae on floor. Teeth small, in up to 30 rows. A pair of angular cartilages between jaw and hyomandibula. Pelvic fins broad, covered by disc. Tail long, longer than disc width; base slender, its greatest width about 1/2 of interorbital space; tail long posteriorly from caudal stings; dorsal and ventral folds well developed; enlarged dorsal tail thorns not numerous, arranged in a single, irregular row; few lateral tail thornlets present near caudal stings. Caudal stings long.

COLOUR. Dorsal colour light or dark brown, or greenish to greyish brown, adults covered with small black specks of irregular shapes; juveniles reported to have a reticulate darker dorsal pattern. Ventral disc and pelvic fins whitish to beige with dark margins.

SIZE. Attains 56 cm DW (~90 cm TL), males much smaller, to 38 cm DW. Males mature at ~12 cm DW, females at ~14 cm DW; born at ~7 cm DW.

HABITAT AND BIOLOGY. South America; Lake Maracaibo basin (Venezuela), and also in upper reaches of the Catatumbo River (Colombia). Feeds on insects. Litters of 3 pups reported. Exported in the aquarium trade.

SIMILAR SPECIES. Distinctive in its adult colour pattern and distributional range; somewhat similar to the Magdalena Freshwater Stingray (26.18), but has fewer denticles and a different adult coloration.

PACIFIC CHUPARE

26.33

Styracura pacifica (Beebe & Tee-Van, 1941)

NE

IDENTIFICATION. Small chupare stingray with a subcircular disc (slightly wider than long) with very rounded apices, small knob-like protuberance on anterior snout, and dorsal coloration uniform dark brown to pinkish brown without conspicuous markings. Head and branchial region very broad. Snout broad, with a rounded–angular anterior margin. Eyes bulging but not large. Spiracles rhomboidal, large, much larger than eyes, obliquely positioned. Nasal curtain broad, wider posteriorly, with fringed posterior margin. Mouth with 5 oral papillae on mouth floor, and short labial folds. Teeth small and broad, in up to at least 35 upper and lower rows. Discrete angular cartilages absent. Denticles numerous, rather large, and evenly distributed on disc, snout, and dorsal and lateral tail; denticles on dorsal mid-disc and shoulder quadriradiate, with distally subdividing radii; pearl thorns sometimes present on shoulder; low, blunt thorns on dorsal tail mid-row; small, sharp denticles on tail extremity. Pelvic fins protrude beyond disc. Tail long and tapering, as broad as 1/2 interorbital width at base, with lateral ridges and a low ventral ridge at base. Caudal sting single or double, very long and slender, and situated far back on tail.

COLOUR. Dorsal surface dark brown to pinkish brown, darkest at margins, pelvic fins and tail; no intricate markings on disc. Ventrally creamy white with narrow dark margins on disc and pelvic fins; tail undersurface dark.

SIZE. Attains at least ~60 cm DW (150 cm TL), but may reach larger sizes.

HABITAT AND BIOLOGY. Central America; Oaxaca (Mexico) to at least Panama in Pacific, also Galapagos Islands; records from Colombia need verification. Feeds in shallow water on shrimps and molluscs. Biology largely unknown.

SIMILAR SPECIES. Morphologically similar to, but smaller than the Atlantic Chupare (26.34), from which it differs in having smaller eyes and a more angled snout. Previously placed in the genus *Himantura* of the family Dasyatidae.

ATLANTIC CHUPARE

26.34

Styracura schmardae (Werner, 1904)

DD

IDENTIFICATION. Large chupare stingray with a subcircular disc (slightly wider than long) with rounded apices, small protuberance on anterior snout, and dorsal coloration mostly plain brownish olive without conspicuous markings. Branchial region broad. Snout broad, rounded anteriorly. Eyes small, slightly bulging. Spiracles very large, rhomboidal, much larger than eyes, and obliquely set. Nasal curtain broad, with fringed posterior margin. Mouth with 5 oral papillae on mouth floor; short labial folds. Teeth small and broad, in up to at least 40 upper and lower rows. Discrete angular cartilages absent. Denticles numerous, large, close-set, broad and flat, and evenly distributed on disc, snout and dorsal tail; lateral tail denticles more acute; denticles on dorsal mid-disc and shoulder larger (quadriradiate bone with radii subdividing distally); usually with 2 much larger pearl thorns on shoulder; small, sharp denticles on tail extremity. Pelvic fins protrude beyond disc. Tail long and tapering, broad based, with lateral ridges and a low ventral fold at base; without enlarged dorsal thorns. Caudal sting usually single, very long (more than twice interorbital width), slender, and situated far back on tail.

COLOUR. Dorsal surface usually brownish or greenish brown, darker at margins and along posterior tail; disc lacking conspicuous markings. Ventrally yellowish white, sometimes with darker greyish disc and pelvic-fin margins; tail undersurface dark.

SIZE. Attains ~180 cm DW and up to 100 kg; males at 60 cm DW still immature.

HABITAT AND BIOLOGY. Western Central Atlantic; Gulf of Campeche (Mexico) to Amazon River mouth (Brazil), and Lesser and Greater Antilles. May be locally abundant; in shallow waters to 30 m depth. Biology and diet unknown.

SIMILAR SPECIES. Very similar to the Pacific Chupare (26.33) but attains a greater size. Also has relatively larger eyes, and a more rounded anterior snout margin. Previously placed in genus *Himantura* of the family Dasyatidae.

27

ROUND RAYS

Family Urotrygonidae

P.R. Last & J.D. McEachran

Round rays are small stingrays (17–70 cm TL as adults and weighing at least 2.2 kg) with an oval to almost circular disc that is variably depressed. Their head is barely distinguishable from the part of the disc formed by the pectoral fins. The snout varies from very short and obtuse to long and pointed, the mouth is usually positioned forward on the ventral disc, and the jaws have rows of small flattened to pointed teeth arranged in quincunx. Small fleshy papillae are usually present on the mouth floor. The tail is relatively broad based, usually shorter than the disc, and lacks dorsal and anal fins. A well-developed caudal fin, consisting of short dorsal and longer ventral lobes, varies from rather short to very elongate. Species normally have a serrated stinging spine preceding the caudal fin, and sometimes have a narrow skin fold on each side of the tail. Pelvic fins are located at the base of the tail. The skin may be entirely smooth to being covered with small denticles and/or thorns dorsally. The family is represented by about 16 living species in 2 genera, *Urobatis* and *Urotrygon*. Round rays are confined to warm temperate and tropical continental shelves of the Western Atlantic and Eastern Pacific where they are mainly demersal inshore, rarely deeper than 90 m. Once thought to belong to the Indo–Pacific family Urolophidae (stingarees), they are now known to be more closely related to the Neotropical stingrays (family Potamotrygonidae) of South America. Some species venture into estuaries but none is considered to live entirely in freshwater. They are aplacental viviparous rays with litters of 1–6 pups that typically gestate over ~6 months. Caught as bycatch by inshore trawlers, and in beach seines and set nets, but rarely used for food. Some species are valuable to the aquarium trade.

KEY TO UROTRYGONID GENERA

1. Tail length less than one-half of total length (fig. 1); dorsal lobe of caudal fin about 1/4 as high as long (fig. 3); dorsal and ventral lobes of caudal fin confluent (fig. 3); amphi-American .... ***Urobatis*** **(6 species; fig. 5, pp. 658–663)**

   Tail length greater than one-half total length (fig. 2); dorsal lobe of caudal fin less than 1/6 as high as long (fig. 4); dorsal and ventral lobes of caudal fin not confluent (fig. 4); amphi-American .... ***Urotrygon*** **(10 species; fig. 6, pp. 664–673)**

fig. 1

fig. 2

fig. 3

fig. 4

view of tail near caudal sting

fig. 5

fig. 6

BULLSEYE ROUND RAY

27.1

Urobatis concentricus Osburn & Nichols, 1916

DD

IDENTIFICATION. Medium-sized, smooth-skinned round ray with a subcircular disc, eye medium-sized, tail short, upper lobe of caudal fin high, short and stubby, and dorsal colour pattern consisting of concentric markings on disc and dark stripe along tail. Disc anterior margin almost straight, disc width 59–62% TL and ~0.9–1 times its length; pectoral-fin lateral margin very broadly and evenly rounded. Snout moderately long; exposed eye 5.9–7.2% of precloacal length, orbit length 2.9–3.1 in snout length; interorbital space 1.1–1.2 times orbit. Mouth barely arched, with 27–36 tooth rows in upper jaw. Nasal curtain skirt-shaped, nostrils slit-like. Skin lacking denticles and thorns. Tail thick based, length 47–48% TL, much shorter than disc; lateral skin folds most prominent forward of caudal sting. Usually with 1 short caudal sting positioned near end of tail, recessible into groove and its length slightly shorter than caudal fin. Caudal-fin upper lobe length 11–14% TL, ~5–7 times its height; tip bluntly rounded or indented slightly. Pelvic fins broadly triangular, apex rounded, length slightly exceeding width. Vertebral centra before sting 113–123.

COLOUR. Dorsal surface pale brown to greyish brown with striking pattern of dark brown saddles and rings centrally, and concentric bands on outer disc; tail with dark median stripe and anterior part of caudal fin paler below than above; eye golden. Ventral surface and skin folds on sides of tail uniformly white.

SIZE. Attains ~48 cm TL.

HABITAT AND BIOLOGY. Eastern Pacific; Baja and Gulf of California to southern Mexico (Isthmus of Tehuantepec). Benthic inshore in bays, lagoons and estuaries on soft bottoms to depths of 30 m. Life history information limited.

SIMILAR SPECIES. Similar in general appearance to the Spotted Round Ray (27.4) and Haller's Round Ray (27.2) and the three forms have been considered by some scientists as colour variations of a single species. Molecular studies have confirmed recently that all three are valid species.

HALLER'S ROUND RAY

27.2

Urobatis halleri (Cooper, 1863)

LC

IDENTIFICATION. Medium to large, smooth-skinned round ray with a subcircular disc, eyes small and widely separated, tail short, upper lobe of caudal fin high, short and stubby, and dorsal surface with clusters of small dark spots or fine white spots and reticulations. Disc anterior margin almost straight, disc width 56–60% TL and equal to its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout moderately long; exposed eye 4.3–5.2% of precloacal length, orbit length 2.7–3.5 in snout length; interorbital space 1.6–1.9 times orbit. Mouth barely arched, with 26–35 tooth rows in upper jaw. Nasal curtain skirt-shaped, nostrils slit-like. Skin lacking denticles and thorns. Tail thick based, length 49–52% TL, much shorter than disc; lateral skin folds most prominent forward of caudal sting. One short caudal sting positioned near end of tail, subequal to or shorter than caudal fin; groove for caudal sting not especially deep posteriorly. Caudal-fin upper lobe length ~13% TL, 6–7 times its height; tip bluntly rounded or slightly indented. Pelvic fins broadly triangular, apex rounded, length well exceeding width. Vertebral centra before sting 122–132.

COLOUR. Dorsal surface of disc pale brownish, greenish or greyish; densely covered with clusters of small dark spots and/or fine whitish spots and reticulations when found on contoured bottoms (markings often indistinct when on sand); clusters often separated by dark lines, markings extend onto caudal fin and tail. Ventral surface pale, dorsal markings sometimes extend onto underside near disc margin.

SIZE. Attains ~55 cm TL, both sexes mature at ~24 cm TL; born at 6–8 cm DW.

HABITAT AND BIOLOGY. Eastern Pacific; northern California (USA) to Ecuador (Gulf of Guayaquil), including Gulf of California. Demersal inshore on sandy and rubbly bottoms, and near seagrasses; usually occurs shallower than 15 m depth (reported to ~90 m). Adult females produce 2 litters of up to 6 pups each year.

SIMILAR SPECIES. The Bullseye (27.1) and Spotted Round Rays (27.4) have been confused with this species. Neither of the other species has a colour pattern of fine reticulations or clusters of small spots.

YELLOW ROUND RAY

27.3

Urobatis jamaicensis (Cuvier, 1816)

LC

IDENTIFICATION. Large, partially rough-skinned round ray with a narrow oval disc, eyes large, tail short, upper lobe of caudal fin high, short and stubby, and colour pattern consisting of complex series of reticulations. Disc anterior margin weakly convex, disc width 48–50% TL and less than its length; lateral margin of pectoral fin broadly rounded. Snout short, exposed eye 7–8% of precloacal length, orbit length 1.8–2.1 in snout length; interorbital space 0.7–0.8 of orbit. Mouth barely arched, with 26–30 tooth rows in upper jaw. Nasal curtain skirt-shaped, nostrils slit-like. Skin lacking thorns, but with a narrow median band of obscure denticles (often partly embedded). Tail depressed at base, length 48–52% TL, much shorter than disc; lateral skin fold forming a long overhanging ridge. One short depressible caudal sting positioned near end of tail, its length longer than caudal fin; groove behind caudal sting shallow. Caudal-fin upper lobe length 7–8% TL, ~4 times its height; tip bluntly rounded or almost truncate. Pelvic fins broadly rounded, length well exceeding width. Vertebral centra before sting 134–137.

COLOUR. Dorsal surface densely covered with a complex pattern of fine greenish to brownish reticulations; or dark with small whitish to golden spots; caudal fin similar. Ventral surface variable, greenish, brownish or yellowish, with dark spots and reticulations on tail and along margin of disc.

SIZE. Attains 70 cm TL, although usually smaller; males mature at ~20 cm disc width; ~6 cm DW at birth.

HABITAT AND BIOLOGY. Western Central Atlantic; North Carolina (USA) to Guyana, including Gulf of Mexico, Bahamas and Antilles. Mainly inshore, in a variety of habitats, including harbours, bays and estuaries. Litters consist of 2–5 pups. Diet includes small bony fishes and a variety of benthic invertebrates.

SIMILAR SPECIES. Colour pattern similar to Haller's Round Ray (27.2) but latter species lacks denticles on disc and has a broader disc and smaller eyes.

SPOTTED ROUND RAY

27.4

Urobatis maculatus Garman, 1913

DD

IDENTIFICATION. Small to medium-sized, smooth-skinned round ray with a subcircular disc, eyes medium-sized, tail short, upper lobe of caudal fin high, short and stubby, and dorsal surface with variably sized dark spots randomly arranged on brownish to greyish background. Disc anterior margin straight to weakly concave, disc width 53–58% TL and equal to its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout moderately long, tip bluntly pointed; exposed eye 5.2–5.6% of precloacal length, orbit length 2.6–3.3 in snout length; interorbital space 1.1–1.4 times orbit. Mouth barely arched, with 35–37 tooth rows in upper jaw. Nasal curtain skirt-shaped, nostrils slit-like. Skin lacking denticles and thorns. Tail thick based, length 49–53% TL, much shorter than disc; lateral skin folds most prominent forward of caudal sting. One short depressible caudal sting positioned near end of tail, its length subequal to following caudal fin; groove for caudal sting very deep posteriorly. Caudal-fin upper lobe length 11–13% TL, ~5–6 times its height; tip bluntly rounded or slightly indented in young. Pelvic fins broadly subtriangular, apex rounded, length well exceeding width. Vertebral centra before sting 116–120.

COLOUR. Dorsal surface brownish to greyish brown, covered with irregular, variable-sized and randomly spaced, darker brownish spots, blotches and speckles; paler blotches over central disc when live; caudal fin speckled. Ventral surface white, margins of disc from level of mouth and pelvic fins darker.

SIZE. Attains at least 42 cm TL; more commonly between 27 and 30 cm TL.

HABITAT AND BIOLOGY. Eastern Pacific from southern half of Baja California (Bahia Sebastian Vizcaino), Gulf of California to Central Mexico (Puerto Vallarta). Demersal inshore on rubbly bottoms to 30 m depth. Presumably caught as incidental bycatch of prawn trawlers but nothing much known of its life history.

SIMILAR SPECIES. Similar in shape to the Bullseye Round Ray (27.1) and Haller's Round Ray (27.2) but can be distinguished by its blotched and speckled coloration. Co-occurs with Haller's Round Ray and once thought to be a colour variant of this species. New DNA evidence supports its recognition as a distinct species.

LEOPARD ROUND RAY

27.5

Urobatis pardalis Moral-Flores, Angulo, Lopez & Bussing, 2015

NE

IDENTIFICATION. Medium-sized, smooth-skinned round ray with a circular disc, eyes small and widely separated, tail very short, upper lobe of caudal fin high, short and stubby, and dorsal surface with dense, fine brownish reticulations. Disc anterior margin convex, disc width 64–66% TL and equal to its length; pectoral-fin lateral margin very broadly and evenly rounded. Snout moderately long to short, exposed eye ~6–7% of precloacal length, orbit length 2.7 in snout length of adult; interorbital space ~1.4 times orbit. Mouth barely arched, 27–33 tooth rows in upper jaw. Nasal curtain skirt-shaped, nostrils slit-like. Skin lacking denticles and thorns. Tail rather thick based, length 46–48% TL, much shorter than disc; lateral skin fold forming a ridge. One short sting positioned near end of tail, longer than upper lobe of caudal fin; groove for caudal sting shallow posteriorly. Caudal-fin upper lobe length 7.5–8.9% TL, 1.9–2.2 times its height; tip broadly rounded. Pelvic fins broadly triangular, apex narrowly rounded, length slightly shorter than width.

COLOUR. Dorsal surface yellowish or whitish, densely covered in adults with very fine brownish or orange reticulations; young with thick dark rings on central disc and concentric broken lines around its margin (which presumably become thinner and more numerous with age). Ventral surface whitish or with pink tinges.

SIZE. Attains ~38 cm TL, males mature at ~30–32 cm TL; born at ~14 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; off Costa Rica. Probably most abundant inshore and largely benthic on soft bottoms; most specimens collected shallower than 15 m depth (reported to 53 m).

SIMILAR SPECIES. Recently described but differs only slightly from Haller's Round Ray (27.2) in body dimensions and colour. These forms need further DNA investigation to confirm that they are separate species. Alternatively, this round ray may be a close relative of or even identical with *Urobatis marmoratus* (Philippi, 1892) from Chile, which is unrecognisable from the original drawing and the type is now missing.

TUMBES ROUND RAY

27.6

Urobatis tumbesensis (Chirichigno & McEachran, 1979)

DD

IDENTIFICATION. Medium-sized, very rough-skinned round ray with a subcircular disc, eyes small and moderately separated, tail short, upper lobe of caudal fin high, short and stubby, and dorsal surface with pale spots and flecks on dark background (spots and flecks clustered along margin of disc). Disc anterior margin convex, disc width 60–62% TL and equal to its length; pectoral-fin lateral margin very broadly and evenly rounded. Snout moderately long, exposed eye ~4.4% of precloacal length, orbit length 3.5–4.4 in snout length; interorbital space ~1.7 times orbit. Mouth barely arched, with ~30 tooth rows in upper jaw. Nasal curtain skirt-shaped and widest posteriorly, nostrils oval. Skin on dorsal surface and caudal fin densely covered with long prickles; median row of large upright thorns extending from nuchal region to caudal sting, and 3 similar large thorns on each shoulder; ventral surface smooth apart from parts of tail. Tail thick based, length about half of total length, much shorter than disc; lateral skin fold short, base shorter than interorbital space. One long caudal sting positioned toward end of tail, its length greatly exceeding caudal fin; groove for caudal sting shallow. Caudal-fin upper lobe length ~8% TL, 5 times its height; tip almost truncate. Pelvic fins broadly rounded, length well exceeding width. Vertebral centra before sting 124.

COLOUR. Dorsal surface dark brown with a few irregular black blotches and dense covering of small whitish spots and flecks, those on outer disc clustered; pale markings largest near caudal sting and on sides of tail. Ventral surface of disc white centrally, surrounded by broad dark margin containing large white blotches; tail similarly blotched.

SIZE. Attains ~41 cm TL, males mature at ~ 30 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; northern Peru to Colombia. Coastal in shallow water in estuaries and mangrove swamps to at least 20 m depth. Biology otherwise largely unknown.

SIMILAR SPECIES. The extremely rough skin of this species distinguishes it from all other members of the family and most other stingrays.

SPINYTAIL ROUND RAY

27.7

Urotrygon aspidura (Jordan & Gilbert, 1882)

DD

IDENTIFICATION. Medium-sized, smooth-skinned round ray with a broad subcircular disc, small eyes, moderately long tail, upper lobe of caudal fin low and long, thorns along tail, and dorsal surface plain brown. Anterior disc margin acute, disc width 49–50% TL and 1–1.1 times its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout moderately long, more so in adult males; exposed eye 2.6–4.5% of precloacal length, orbit length 5–6.3 in snout length; interorbital space 1.9–2.7 times orbit. Mouth well arched, upper jaw with 28–46 tooth rows. Nasal curtain short, skirt-shaped, nostrils oval. Skin smooth; denticles unobvious, minute and very widely spaced; no thorns on disc. Tail rather depressed and broadly oval in cross-section, length 56–59% TL; usually lacking lateral skin folds; 2–7 large oval-based, elongate keel-shaped thorns forward of caudal sting. One long, slender caudal sting positioned near middle of tail, its length much shorter than caudal fin. Caudal-fin upper lobe length 18–21% TL, ~19–22 times its height, much shorter than lower lobe; rear tip narrowly pointed. Pelvic fins narrowly triangular, apex bluntly pointed, width subequal to length. Vertebral centra before sting 84–94.

COLOUR. Dorsal surface pale to medium brown, orbit and upper edge of spiracle white, median part of clasper dark brown; caudal sting and thorns greyish blue. Ventral surface uniformly whitish; caudal fin with a black median stripe, upper lobe darker than lower lobe.

SIZE. Attains at least 42 cm TL, males mature at ~24 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Baja California and Central Mexico (Mazatlan) to northern Peru (Punta Negra). Benthic on soft bottoms at 5–25 m depths. Poorly known. Taken as bycatch of shrimp fisheries.

SIMILAR SPECIES. Only member of family with elongate keel-shaped thorns confined to the mid-line of the tail. Other round rays with enlarged denticles or thorns along tail also have them along disc.

CHILEAN ROUND RAY

27.8

Urotrygon chilensis (Günther, 1872)

DD

IDENTIFICATION. Medium-sized, partially smooth-skinned round ray with a very broadly oval disc, large eyes, moderately long tail, upper lobe of caudal fin low and very long, bluntly tipped or pointed thorns along mid-line of disc and tail, and dorsal surface with black blotches and speckles on a brown background. Anterior disc margin obtuse, disc width 57–59% TL and 1.1–1.2 times its length; lateral margin of pectoral fin rounded. Snout moderately long, most extended in adult males; exposed eye 4.7–5.1% of precloacal length, orbit length 3.6–4.3 in snout length; interorbital space 1.5–1.8 times orbit. Mouth arched slightly, upper jaw with 32–48 tooth rows. Nasal curtain expanded slightly near mouth, nostrils narrowly oval. Skin rough on central disc, more widespread in largest adults; young mostly naked, lacking dense denticle patch on snout. Thorns short, sharp and tilted slightly; row variably developed in young, broken or continuous in adults. Tail slender-based, length 53–56% TL; lacking lateral skin folds. Caudal sting slender, positioned well forward of tail tip, usually shorter than upper caudal fin. Caudal-fin upper lobe length 15–18% TL, ~14–19 times its height. Pelvic fins broadly triangular, apex rounded, length usually slightly exceeding width. Vertebral centra before sting 84–97.

COLOUR. Dorsal surface dark brown with small, irregular brownish black blotches and speckles, usually present at all stages of growth; upper edge of spiracle white and thorns not contrasted with body colour; end of caudal fin entirely black. Ventral surface white, margins of disc and pelvic fins usually dusky.

SIZE. Attains ~43 cm TL, males mature at ~24 cm TL.

HABITAT AND BIOLOGY. Eastern Pacific; south-western Baja California and Gulf of California (Mexico) to northern Chile. Rather common in some parts of its range, but biology poorly known.

SIMILAR SPECIES. Distinguished from other species of family that are sparsely or partially covered with denticles and thorns along mid-line of disc and tail, by its colour pattern of irregular dark blotches and speckles, and by its broad angular snout. Cimar Round Ray (27.9) has similar colour pattern but lacks thorns on disc and tail. Populations of Chilean Round Ray at either end of its range differ subtly in several aspects and may represent different species.

CIMAR ROUND RAY

27.9

Urotrygon cimar López & Bussing, 1998

NE

IDENTIFICATION. Medium-sized, rough-skinned round ray with a circular disc, very small eyes, tail subequal to disc length, caudal fin moderately elongate and deep, no enlarged thorns on central disc or tail, and dorsal surface with numerous dark blotches on brown background. Anterior margin of disc acutely pointed, disc width 55–59% TL and ~1–1.1 times its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout moderately long, 28–29% disc length; exposed eye 3.6–4.6% of precloacal length, orbit length 4.1–5.2 in snout length; interorbital space 1.8–2.2 times orbit. Mouth arched slightly. Nasal curtain skirt-shaped, nostrils small. Skin on dorsal surface covered with tall, widely spaced denticles in both young and adults, largest on mid-disc. Tail rather deep, length 52–54% TL; lacking lateral skin folds. Single long slender caudal sting positioned at rear of tail, its length longer than caudal fin. Caudal-fin upper lobe length 12–14% TL, ~6–9 times its height, only slightly shorter than lower lobe; rear tip narrowly rounded. Pelvic fins broadly triangular, apex rounded, length greatly exceeding width. Vertebral centra before sting 75–77.

COLOUR. Dorsal surface of disc greyish brown with dense cover of darker brown blotches; caudal fin blackish above and below, most pronounced in young. Ventral surface largely white, disc and pelvic fins with broad greyish margins; upper and lower surfaces not strongly demarcated from each other on side of tail.

SIZE. To 38 cm TL, males mature at ~22 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; central Mexico to Costa Rica. Benthic on soft bottoms mainly inshore and shallower than 10 m, but recorded at depths to 85 m.

SIMILAR SPECIES. Most closely resembles the Munda Round Ray (27.11) but denticles along the mid-disc are not distinctly enlarged to form a band consisting of several irregular rows of spiny thorns.

SMALLEYE ROUND RAY

27.10

Urotrygon microphthalmum Delsman, 1941

LC

IDENTIFICATION. Small, almost entirely smooth round ray with a circular disc, small eyes, long tail, dorsal lobe of caudal fin elongate and slender, without thorns, and dorsal surface plain greyish to yellowish brown. Anterior margin of disc acute, disc width 46–49% TL and equal to its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout very long; exposed eye 1.8–2.4% of precloacal length, orbit length 8–11 in snout length; interorbital space 3.1–3.7 times orbit; large females with a fleshy horn above eye. Mouth arched slightly, upper jaw with 28–43 tooth rows. Nasal curtain broadly skirt-shaped, nostrils oval. Skin on upper disc and tail sparsely covered with minute upright denticles in largest females, densest around eyes; otherwise smooth or with scattered denticles. Tail narrow based, length 56–59% TL; lateral skin folds narrow. Usually with 1 very long slender caudal sting positioned near middle of tail, its length usually shorter than caudal fin. Caudal-fin upper lobe length 17–19% TL, ~18–21 times its height, length about equal to lower lobe; fin tapered with rear tip narrowly rounded. Pelvic fins narrowly triangular, apex angular to narrowly rounded, width shorter than length. Vertebral centra before sting 66–77.

COLOUR. Dorsal surface uniform greyish to pale yellowish brown, anterior disc margin white; pupil of eye black; caudal fin pale medially, lobes darker brown. Ventral surface white, disc margin and pelvic-fin margins sometimes slightly darker.

SIZE. Attains ~30 cm TL and 13.5 cm DW; males mature at ~23 cm TL, born at ~8 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; eastern Venezuela (Paraia) to northern Brazil. Benthic in coastal waters at depths of 15–55 m. Reproductive biology unknown but 1 specimen found to be hermaphroditic. Reported to be an opportunistic predator feeding on benthic invertebrates and plankton. Taken as bycatch of local shrimp fisheries.

SIMILAR SPECIES. The Dwarf Round Ray (27.12) is similar but has rough skin, relatively wider disc, and less tapered caudal fin.

MUNDA ROUND RAY

27.11

Urotrygon munda Gill, 1863

DD

IDENTIFICATION. Small, rough-skinned round ray with a circular disc, small eyes, tail moderately long, dorsal lobe of caudal fin rather short and deep, band of enlarged thorny denticles along mid-line of disc, and dorsal surface with numerous dark blotches on a greyish to brownish background. Anterior margin of disc forming obtuse angle, disc width 51–54% TL and 1–1.1 times its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout long, 28–30% disc length; exposed eye 3.6–4.1% of precloacal length, orbit length 5–6.7 in snout length; interorbital space 1.9–2.7 times orbit. Mouth arched slightly, upper jaw with 27–36 tooth rows. Nasal curtain short, skirt-shaped, nostrils oval. Skin on dorsal side uniformly covered with upright, widely spaced denticles; denticles enlarged along mid-disc but not in definite rows. Tail rather deep, length 52–56% TL; lacking lateral skin folds. Single, long, slender caudal sting positioned at rear of tail, usually longer than upper caudal-fin lobe. Caudal-fin upper lobe length 11–12% TL, ~8–10 times its height; rear tip truncate to abruptly pointed. Pelvic fins narrowly triangular, apex angular to narrowly rounded, length slightly exceeding width. Vertebral centra before sting 72–77.

COLOUR. Dorsal surface of disc greyish to brownish with dense pattern of darker blotches; caudal fin blackish above and below, most pronounced in young. Ventral surface mostly white on tail and centrally on disc; disc and pelvic fins usually with broad dusky margins; tail undersurface not strongly demarcated on side from dorsal surface.

SIZE. To at least 25 cm TL, males mature at ~20 cm TL; born at ~9 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; central Mexico (Manzanillo) to Peru. Demersal inshore on soft bottoms at depths of 5–50 m. Life history poorly known.

SIMILAR SPECIES. The Cimar Round Ray (27.9) is similar in appearance but is less spiny and lacks a band of enlarged thorny denticles along the mid-line of the disc.

DWARF ROUND RAY

27.12

Urotrygon nana Miyake & McEachran, 1988

DD

IDENTIFICATION. Very small, rough-skinned round ray with broad subcircular disc, small eyes, tail long, dorsal lobe of caudal fin elongate and very slender, no thorns, and dorsal side plain dark brown or weakly mottled light brown. Anterior margin of disc forming obtuse angle, disc width 55–57% TL and ~1–1.1 times its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout long, 30–31% disc length; exposed eye usually 2.4–3.2% of precloacal length, orbit length 6.6–7.9 in snout length; interorbital space 2.4–2.9 times orbit. Mouth arched slightly, upper jaw with 29–36 tooth rows. Nasal curtain skirt-shaped, flared apically, nostrils small. Skin on upper disc uniformly granular; individuals larger than 9 cm almost entirely and densely covered with small, strongly recurved denticles; denticles sometimes absent from centres of pectoral fins of adults. Tail broad based, 53–55% TL, without lateral fold. Usually with 1 long caudal sting variably positioned, but often rather forward on tail, its length subequal to caudal fin. Caudal-fin upper lobe length usually 14–16% TL and ~8–10 times its height; fin not tapered with rear tip abruptly rounded. Pelvic fins narrowly triangular, apex angular, width usually much less than length. Vertebral centra before sting 57–67.

COLOUR. Dorsal surface uniformly chocolate brown to weakly mottled pale brown, or occasionally lightly speckled, disc edge white. Ventral surface mainly white; margins of disc and pelvic fins broadly pale brown; mid-line of tail usually with a broad brown stripe.

SIZE. Attains at least 26 cm TL, males mature at 15–17 cm TL; born at ~6 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; central Mexico (Mazatlan) to Panama. Locally common and benthic along coastal fringe at depths of 2–15 m, often in mangrove swamps. Low fecundity, with females producing 1 embryo at a time.

SIMILAR SPECIES. The Smalleye Round Ray (27.10) and Munda Round Ray (27.11) are similar but have narrower discs and more tapered caudal fins, and the Munda Round Ray has enlarged thorns along mid-line.

RETICULATE ROUND RAY

27.13

Urotrygon reticulata Miyake & McEachran, 1988

VU

IDENTIFICATION. Small, finely granular-skinned round ray with subcircular disc, small eyes, rather long tail, upper and lower caudal lobes long and low, no thorns along mid-line, and dorsal surface with fine reticulations on pale background. Anterior margin of disc obtusely angled, disc width 53–57% TL and 1–1.1 times its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout short in adults, margin almost straight, exposed eyes 4.3–4.5% of precloacal length, orbit length 3.7–4.1 in preorbital snout length; interorbital space 1.3–1.4 times orbit. Mouth weakly arched, upper jaw with 34–38 tooth rows. Nasal curtain skirt-shaped, long and narrow, margin well fringed; nostrils elongate. Skin naked in young; not rough in adults but with fine denticles densely covering snout, becoming sparse over mid-disc, and absent over hind disc, pelvic fins and all of tail; undersurface smooth; disc and tail thornless. Tail length 51–54% TL; with weak lateral skin folds. Usually with 1 caudal sting positioned posteriorly on tail; subequal to or longer than caudal fin. Upper lobe of caudal fin rather short, length 11–15% TL and 8–9 times its height; rear tip broadly rounded. Pelvic fins subtriangular, anterior margin straight to slightly convex, apex narrowly rounded, posterior margin weakly convex; anterior margin subequal to its total length. Vertebral centra before sting 68–69.

COLOUR. Dorsal surface pale, covered with fine brown reticulations; more diffuse speckled markings near disc margin, and on pelvic fins and upper lobe of caudal fin. Ventral surface white, lower caudal lobe paler than upper lobe.

SIZE. Attains at least 24 cm TL; male paratype mature at 18 cm disc width.

HABITAT AND BIOLOGY. Eastern Central Pacific; off Panama. Benthic in shallow coastal waters at 1–15 m depths. Considered rare and little is known of its life history.

SIMILAR SPECIES. A colour pattern of fine reticulations uniformly covering the dorsal surface distinguishes this species from other members of the genus.

ROGERS' ROUND RAY

27.14

Urotrygon rogersi (Jordan & Starks, 1895)

DD

IDENTIFICATION. Medium-sized, mostly smooth-skinned round ray with a broadly oval disc, small eyes, tail moderately long, upper and lower lobes of caudal fin long and low, thorns present in complete or incomplete row along mid-line of disc and tail, and dorsal surface plain brownish. Anterior margin of disc acutely pointed, disc width 62–64% TL and 1.1–1.3 times its length; lateral margin of pectoral fin sharply rounded. Snout long; exposed eye 4.4–5.1% of precloacal length, orbit length 4.2–4.7 in snout length; interorbital space 1.5–1.8 times orbit. Mouth arched slightly, upper jaw with 32–46 tooth rows. Nasal curtain skirt-shaped, nostrils small. Denticles absent or small and embedded beside thorns over abdomen; thorns short with crowns tilted slightly; thorns absent in small juveniles, in broken series on disc and tail in large juveniles and in continuous series on disc and tail in adults. Tail slender-based, length 52–55% TL; lacking lateral skin folds. Caudal sting robust, broad based, positioned well forward on tail, its length shorter than upper caudal fin. Caudal-fin upper lobe length 16–17% TL, ~12–19 times its height, much shorter than lower lobe; rear tip abruptly rounded. Pelvic fins broadly triangular, apex rounded, width usually exceeding length. Vertebral centra before sting 93–103.

COLOUR. Dorsal surface uniformly dark greyish brown, edges of disc, orbit and spiracle white; spine bases often white; upper and lower coloration sharply demarcated on side of tail; caudal fin almost entirely black with a pale margin. Ventral surface white, posterior margins of disc and pelvic fins often slightly darker; dark stripe sometimes along mid-tail.

SIZE. Attains ~46 cm TL, males mature at ~29 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; Baja California and the Gulf of California (Mexico) to Ecuador. Demersal on soft bottoms from mostly shallow water nearshore to at least a depth of 30 m. Caught commonly as prawn trawl bycatch. Feeds largely on prawns and polychaete worms.

SIMILAR SPECIES. Like the Chilean Round Ray (27.8), this species has prominent thorns in a row along the mid-line of the disc and tail. These two species differ subtly in body shape with Rogers' Round Ray having a relatively broader disc and lacking dark blotches on the dorsal surface.

FAKE ROUND RAY 27.15

Urotrygon simulatrix Miyake & McEachran, 1988

VU

IDENTIFICATION. Small, rough-skinned round ray with a subcircular disc, small eyes, long tail, upper and lower lobes of caudal fin long and low, 1 or 2 rows of upright thorns along mid-line of disc and tail, and dorsal surface uniform brown. Anterior margin of disc obtusely pointed, disc width 51–53% TL, 1–1.2 times its length; lateral margin of pectoral fin rounded. Snout rather elongate, tip not extended, margin weakly convex, exposed eye 4.5–4.8% of precloacal length, orbit length 3.8–4.1 in snout length; interorbital space 1.7–1.9 times orbit. Mouth arched slightly, upper jaw with 29–35 tooth rows. Nasal curtain skirt-shaped, margin well fringed; nostrils elongate. Upper disc and tail covered with short, widely spaced conical denticles, smallest near disc margin; undersurface smooth. Thorns cone-shaped, only weakly recurved, bases stellate; height less than 2 mm. Tail rather broad based, length 51–56% TL; angular on sides, central half with low lateral keel. Caudal sting positioned posteriorly on tail; subequal to caudal-fin length. Upper lobe of caudal fin broadly elongate, ~15% TL, ~11 times its height; rear tip narrowly rounded. Pelvic fins broadly triangular, anterior margin straight, apex broadly rounded, posterior margin convex; anterior margin much less than its total length. Vertebral centra before sting 83–86.

COLOUR. Dorsal disc dark greyish brown with pale margin in preservative, pelvic fins and tail similar. Ventral surface whitish with margins of disc and pelvic fins brownish; brownish stripe usually extending along mid-line of tail.

SIZE. Attains ~27 cm TL.

HABITAT AND BIOLOGY. Eastern Central Pacific; off Panama. Benthic on soft bottoms in shallow coastal water. Despite being taken as prawn trawl bycatch nothing is known of its life history.

SIMILAR SPECIES. Unlike other species of family with thorns along the mid-line of disc and tail, the thorns and denticles of this species are cone-shaped with ribbed bases.

VENEZUELAN ROUND RAY

27.16

Urotrygon venezuelae Schultz, 1949

NT

IDENTIFICATION. Small, rough-skinned round ray with a circular disc, small eyes, moderately long tail, upper and lower caudal-fin lobes elongate and slender, band of enlarged denticles along mid-line of disc and tail, and dorsal surface uniform yellowish or brownish. Anterior margin of disc forming obtuse angle, disc width ~54% TL and ~1.1 times its length; lateral margin of pectoral fin very broadly and evenly rounded. Snout long, exposed eye ~3% of precloacal length, orbit length ~5.2 in snout length; interorbital space ~2 times orbit. Mouth weakly arched, upper jaw with 27–38 tooth rows. Nasal curtain skirt-shaped, nostrils slit-like. Skin densely covered with denticles except for lateral and posterior margins of disc, small on snout, 2–3 rows of thorn-like denticles along mid-line of disc and tail; thorny denticles bulbous and recurved with broad, rounded bases. Tail rather slender, length 56% TL; with lateral cutaneous ridge but no distinct keel. Caudal sting broad based, positioned posteriorly on tail, its length about equal to upper caudal fin. Caudal-fin upper lobe length ~14% TL, ~13 times its height; rear tip narrowly rounded. Pelvic fins broadly triangular, apex rounded, width shorter than length. Vertebral centra before sting 74–76.

COLOUR. Dorsal surface yellowish to greyish brown, caudal sting translucent; caudal fin pale brown. Ventral surface white, slightly darker along disc and pelvic-fin margins; tail with irregular dark markings.

SIZE. Attains at least 29 cm TL.

HABITAT AND BIOLOGY. Western Central Atlantic; off western Venezuela. Benthic in coastal habitats. Nothing known of its life history but taken as bycatch of shrimp fisheries.

SIMILAR SPECIES. Distinguished from the other plain-coloured round rays that are covered with denticles, the Munda (27.11) and Dwarf Round Rays (27.12), by its continuous row of enlarged denticles along the mid-line of disc and tail (absent in Dwarf Round Ray), and its relatively short snout (~13% *vs.* ~14% TL in Munda Round Ray). Also, enlarged denticles have large circular bases in the Venezuelan Round Ray and smaller stellate bases in the Munda Round Ray.

28

GIANT STINGAREES

Family Plesiobatidae

B. Séret & P.R. Last

Giant stingarees are large rays (adults to 2.7 m TL and 1.3 m DW) with an ovoid disc, and a tail armed with a strong venomous caudal sting. Like stingarees (Urolophidae), round stingrays (Urotrygonidae) and sixgill stingrays (Hexatrygonidae), they have a well-developed caudal fin at the end of the tail consisting of long-based upper and lower lobes. Their body is heavy and flabby, and the skin is densely covered with small denticles. The triangular snout is long, broad and flattened, and five pairs of short gill slits are located on the ventral head. The tail is rather long and slender, and the caudal fin is more elongate than in most other rays. Small eyes are positioned almost laterally on head, very close to small spiracles. Mouth rather large, not highly protractile. Nostrils are well separated with nasal flaps fused to form a broad nasal curtain that does not overlap the mouth. Viviparous (histotrophic). The family includes only a single species whose known distribution is patchy in deep waters of the Indo–Pacific. Despite its widespread distribution, the giant stingaree is captured infrequently, although it has been reported as common in some areas.

GIANT STINGAREE

28.1

Plesiobatis daviesi (Wallace, 1967)

LC

IDENTIFICATION. Giant stingaree with a soft, rounded–oval disc, broadly triangular and pointed snout, long-based caudal fin, and skin much darker on dorsal surface than undersurface. Disc subcircular in young, becoming oval in adults; depressed, thickened slightly through abdomen but greatly flattened around its outer half. Snout flexible, without rostral cartilage, supported only by anterior pectoral radials; small lobe present at tip. Tail narrow based, slender (but not whip-like), shorter than disc, and usually with a strong caudal sting; caudal fin elongate and slender, base about half length of tail. Eyes small, orbit length up to 6 times in snout length. Nostrils expanded, subcircular. Nasal curtain broad and short, falling well short of mouth, posterior margin finely fringed. Mouth large without oral papillae. Teeth small, with rounded crown and short cusps. Upper disc and tail densely covered with small denticles, even in small specimens; undersurface of disc smooth.

COLOUR. Dorsal surface greyish, purplish or reddish brown, becoming darker in preserved specimens. Tail dark brownish to black on all surfaces; caudal fin black. Ventral surface white, with narrow dark margins (most pronounced on hind disc and tips of pelvic fins); claspers usually with white bases and dark tips.

SIZE. Attains 270 cm TL and 42 kg. Males mature at ~130–172 cm TL and females at ~189–200 cm TL; born at ~50 cm TL.

HABITAT AND BIOLOGY. Indo–Pacific; South Africa to Hawaii (USA), known distribution patchy. Deepwater, benthic on soft bottoms of upper continental and insular slopes mainly at 275–680 m depths, rarely venturing onto continental shelves. Feeds on small fishes, crabs, shrimps and cephalopods.

SIMILAR SPECIES. Stingarees of the family Urolophidae are much smaller, have a shorter snout and mostly have a smooth upper disc. Genetic analyses have shown that these two families are closely related.

29

STINGAREES

Family Urolophidae

P.R. Last, G.K. Yearsley & W.T. White

Stingarees are comparatively small rays (adults 30–90 cm TL) with an oval, circular or rhomboidal disc and a short tail with an elongate lobe-like caudal fin. Like many other rays, the head and pectoral fins are unified to form a disc. The body is flattened with the head slightly raised and barely demarcated from the rest of the disc. Their mouth, which is positioned forward on the ventral disc, has rows of small teeth in the jaws and usually several fleshy papillae on its floor. The short, slender tail may have a narrow cutaneous skin fold along each side, but lacks an anal fin and skin folds on the dorsal and ventral mid-lines. Small pelvic fins are located near the base of the tail. Almost all species lack denticles and thorns (except *Spinilophus armatus*), but have 1 or more serrated stinging spines on the tail that are sometimes preceded by a small dorsal fin. The family is represented by 28 living species in 3 genera: *Spinilophus*, *Trygonoptera* and *Urolophus*. They occur in the Indo–Australian Archipelago and North-West Pacific, but most species are restricted to Australian seas. Stingarees closely resemble round rays (Urotrygonidae) from the Eastern Pacific and Western Atlantic Oceans and were once placed together in the same family. They differ subtly in morphology and their distributions on a global scale do not overlap. Larger relatives of the stingarees, the stingrays (Dasyatidae) have a longer tail and lack a caudal fin. Most stingaree species are benthic on the continental and insular shelves but some occur deeper on the slope to at least 420 m depth. Inshore species venture into estuaries but do not occur in freshwater. Viviparous (most are probably trophodermic), producing small litters of 1–4 pups over 10–12 months gestation. Common bycatch of demersal trawling off Australia and Taiwan but rarely used as food.

KEY TO UROLOPHID GENERA

1. A broad and flattened fleshy lobe along entire lateral margin of nostril (fig. 1); Australia .... ***Trygonoptera*** **(6 species; fig. 3, pp. 679–684)**

   No enlarged fleshy lobe extending along lateral margin of nostril (fig. 2) 2

2. Dorsal surface smooth, disc and tail lacking thorns and denticles; Western Pacific and Eastern Indian Oceans ..... ***Urolophus*** **(21 species; fig. 4, pp. 685–705)**

   Dorsal surface of disc with at least some fine denticles and dorsal tail with small thorns on its mid-line; Western Central Pacific .... ***Spinilophus*** **(1 species; fig. 5, p. 678)**

fleshy lobe

oronasal region

fig. 1

fig. 2

fig. 3

fig. 4

fig. 5

NEW IRELAND STINGAREE

29.1

Spinilophus armatus (Müller & Henle, 1841)

DD

IDENTIFICATION. Stingaree with a broad subcircular disc with small thorns and denticles on its dorsal surface, skirt-shaped nasal curtain, long tail with rudimentary skin folds, and lacking both a lobe at border of nostril and a dorsal fin. Disc much wider than long; widest point more than 2 orbit lengths behind level of spiracles. Snout fleshy, tip obviously extended. Eyes very small, orbit length ~16% of snout length; interorbital space broad. Spiracle origin beneath mid-eye. Mouth small with single median papillae on floor with smaller stub-like papillae laterally. Teeth in upper jaw ~24. Nasal curtain posterior angle not extended into distinct lobe and no lobe along its lateral margin; fringe weak. Disc upper surface largely smooth but with some denticles; enlarged mid-scapular thorn and ~4 indistinct rows of sharp, widely spaced spinules extending from hind disc along mid-dorsal tail. Tail elongate (exceeding 90% disc length), with 2 stings, weakly depressed in cross-section before stings; caudal fin very long and slender, tip narrowly rounded.

COLOUR. Brownish with scattered darker blotches, some coalesced. Ventral surface whitish with disc margins dark.

SIZE. Based solely on a juvenile male 17 cm TL collected in the early 1800s.

HABITAT AND BIOLOGY. Western Central Pacific, only known from New Ireland but probably also occurs offshore on insular shelves in parts of Melanesia. Life history unknown.

SIMILAR SPECIES. Unique within the family in having denticles and thorns on the dorsal disc but the skin probably becomes either more or less roughened with age. Comes from a relatively unexplored part of the oceans and more specimens needed.

YELLOW SHOVELNOSE STINGAREE

29.2

Trygonoptera galba Last & Yearsley, 2008

DD

IDENTIFICATION. Small yellowish brown stingaree with a subcircular to rhomboidal disc, skirt-shaped nasal curtain, broad lobe at lateral border of nostril, moderately long tail with no dorsal fin, and no lateral skin folds. Disc slightly wider than long; widest at about an orbit length behind level of spiracles. Snout fleshy, tip not extended. Eyes medium-sized, orbit length 24–26% of snout length. Spiracle origin beneath about mid-eye. Mouth small with ~8–10 papillae on floor; tooth rows in upper jaw 19–20. Nasal curtain posterior angle not extended into distinct lobe; fringe prominent. Disc upper surface smooth. Tail in cross-section almost rounded, slightly depressed anteriorly; moderately long (71–87% disc length); caudal fin moderately narrow and elongate, tip rounded.

COLOUR. Yellowish brown above. Caudal fin yellowish grey or brownish grey. Ventral surface pale yellowish or whitish, often with dusky to blackish lateral disc margins.

SIZE. To at least 39 cm TL, males mature at ~33–36 cm TL; probably born at ~16 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia. Demersal on middle and outer continental shelf at depths of 100–210 m. Probably prefers sandy and muddy bottoms but very little known about its biology.

SIMILAR SPECIES. Very similar to the Western Shovelnose Stingaree (29.4) but differs in being vivid yellow or yellowish brown above rather than greyish or blackish, and in having the anterior extension of the spiracle reaching only to about the level of mid-eye (rather than forward to the anterior third of eye). Smaller than Eastern Shovelnose Stingaree (29.3), and from another form living off south-western Australia which might represent another species.

EASTERN SHOVELNOSE STINGAREE 29.3

Trygonoptera imitata Yearsley, Last & Gomon, 2008

NT

IDENTIFICATION. Large, brownish stingaree with a subcircular disc, skirt-shaped nasal curtain, broad lobe at lateral border of nostril, moderately long tail with no dorsal fin, and no lateral skin folds. Disc wider than long; widest about 1.5–2 orbit lengths behind level of spiracles. Snout fleshy, tip not extended. Eyes medium-sized, orbit length 20–23% of snout length. Spiracle origin beneath anterior half of eye. Mouth small with ~6 papillae on floor; teeth in upper jaw ~22. Nasal curtain posterior angle not extended into distinct lobe; fringe prominent. Disc upper surface smooth. Tail depressed, distinctly oval in cross-section; moderately long (81–89% disc length); caudal fin broad and elongate, tip rounded.

COLOUR. Medium to dark brown, sometimes yellowish, above, often darker centrally and on tail; a few irregularly distributed small brownish or yellowish spots sometimes present. Caudal fin dark brown, outer edge sometimes darker still. Ventral surface pale, with broad, dark lateral margins.

SIZE. To at least 80 cm TL, both sexes mature at ~48 cm TL; born at ~20 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off south-eastern Australia. Demersal in coastal waters, where it is common on sandy and muddy bottoms in large bays and near beaches; often in depths of less than 5 m, but also found to at least 120 m. Litters of up to 7 pups born annually in February or March; pupping normally occurs in sheltered waters. Diet consists mainly of polychaete worms. Caught incidentally in trawl and seine fisheries. Maximum age recorded is about 12 years.

SIMILAR SPECIES. Similar to the smaller Common Stingaree (29.7) but lacks a dorsal fin. Also superficially similar to the Western Shovelnose Stingaree (29.4) but is much larger and differs in internal characteristics and DNA structure.

WESTERN SHOVELNOSE STINGAREE

29.4

Trygonoptera mucosa (Whitley, 1939)

LC

IDENTIFICATION. Small to medium-sized, greyish or brownish black stingaree with a subcircular disc, skirt-shaped nasal curtain, broad lobe at lateral border of nostril, moderately long tail with no dorsal fin, and no lateral skin folds. Disc slightly wider than long; widest about 1.5–2 orbit lengths behind level of spiracles. Snout fleshy, tip rounded. Eyes medium-sized, orbit length 20–27% of snout length. Spiracle origin beneath anterior third of eye, sometimes approaching anterior of eye. Mouth small with ~7–9 small unbranched papillae on floor; teeth in upper jaw 23–32. Nasal curtain posterior angle not extended into distinct lobe; fringe prominent. Disc upper surface smooth. Tail almost oval in cross-section; rather elongate (71–91% disc length); caudal fin narrow and elongate, tip narrowly rounded.

COLOUR. Greyish, yellowish brown or brownish black above, sometimes with irregular scattered yellow and dusky spots. Caudal fin greyish or black. Ventral surface whitish or yellowish, sometimes with very broad, dark brown lateral margins and blotches on disc and tail.

SIZE. To at least 47 cm TL, males mature at ~31–34 cm TL, females larger; born at ~17 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean off southern Australia. Demersal in coastal waters, common on sandy bottoms and near seagrass beds in shallow water; usually in depths less than 20 m but found to at least 40 m. Gives birth to 1–2 pups in autumn or early winter after a 10–12 month gestation. Reaches about 17 years of age; males mature at ~2 years and females at ~5 years. Diet consists primarily of polychaete worms, and small crustaceans.

SIMILAR SPECIES. Resembles the larger Eastern Shovelnose Stingaree (29.3) but differs internally and is genetically distinct. Also similar to the Common Stingaree (29.7) but lacks a dorsal fin. A generally more northern species, the Yellow Shovelnose Stingaree (29.2) has a more yellowish disc. A population from inshore waters near Perth (Western Australia) is larger (to 61 cm TL) and might be a different species.

STRIPED STINGAREE

29.5

Trygonoptera ovalis Last & Gomon, 1987

LC

IDENTIFICATION. Large, greyish or greyish brown stingaree with an oval-shaped disc, skirt-shaped nasal curtain, broad lobe at lateral border of nostril, rather long tail with a dorsal fin but no lateral skin folds, and dorsal surface with two dark longitudinal stripes along the central disc and tail. Disc slightly longer than wide; widest about 1–3 orbit lengths behind level of spiracles. Snout fleshy, tip rounded, not extended. Eyes small- to medium-sized, orbit length 17–22% of snout length. Spiracle origin beneath mid-eye. Mouth small with ~4 tiny papillae on floor; teeth in upper jaw 18–23. Nasal curtain posterior angle not usually extended into distinct lobe; fringe very long. Disc upper surface smooth. Tail oval in cross-section, more depressed anteriorly; rather elongate (75–100% disc length); dorsal fin small; caudal fin somewhat large, short and deep.

COLOUR. Greyish or greyish brown above, with dark mask-like markings around eyes and paired dark blotches on the central disc that extend onto the tail as stripes; often with a dark stripe extending forward of the eyes to the snout tip (more obvious in juveniles); dark markings are obscure in some specimens. Caudal fin greyish or black. Dorsal fin brownish. Ventral surface whitish or yellowish; disc margins and tail mostly dark.

SIZE. To 61 cm TL; males mature at ~35 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off south-western Australia. Demersal in coastal waters from close inshore to depths of ~45 m. A flexible, oval-shaped disc allows it to move freely over reefs without becoming entangled in kelp holdfasts or other obstacles. Prefers hard bottoms and divers sometimes observe it hiding beneath seaweed. Occasionally caught incidentally in inshore fisheries. Little is known of its biology.

SIMILAR SPECIES. Differs from the two other members of the genus *Trygonoptera* that have a dorsal fin, the Common Stingaree (29.7) and the Masked Stingaree (29.6), in having an oval-shaped disc and two distinctive stripes along the posterior disc that extend onto the tail.

MASKED STINGAREE

29.6

Trygonoptera personata Last & Gomon, 1987

LC

IDENTIFICATION. Medium-sized, yellowish or greyish stingaree with a subcircular disc, skirt-shaped nasal curtain, broad lobe at lateral border of nostril, moderately long tail with a dorsal fin but no lateral skin folds, and dorsal surface with dark markings around eyes, a central dark blotch on the disc and no stripes along the disc toward the tail. Disc slightly longer than wide or with length about equal to width; widest slightly more than an orbit length behind level of spiracles. Snout angular, fleshy, tip not extended. Eyes medium-sized, orbit length 21–28% of snout length. Spiracle origin beneath about mid-eye. Mouth very small with 3–4 papillae on floor; teeth in upper jaw 23–26. Nasal curtain posterior angle not extended into distinct lobe; fringe prominent. Disc upper surface smooth. Tail slightly depressed to oval in cross-section; moderately long (67–86% disc length); dorsal fin moderately large; caudal fin moderately long, more elongate in juveniles.

COLOUR. Yellowish brown to grey above, with dark mask-like markings around and between eyes and a dark blotch on the central disc. Caudal fin margin and dorsal fin black in young, greyish in adults. Ventral surface whitish or yellowish; disc margins slightly darker.

SIZE. To ~55 cm TL; males mature by 36 cm TL; born at ~20 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off Western Australia. Demersal on the upper continental shelf, from inshore to depths of at least 115 m. Gives birth to 1–2 pups in April or May after a 10–12 month gestation. The prey items (certain polychaete worms and crustaceans) suggest that the Masked Stingaree feeds in (rather than above) soft substrates.

SIMILAR SPECIES. Differs from its close Western Australian relatives, the Striped Stingaree (29.5) and the Western Shovelnose Stingaree (29.4), by its distinctive masked colour pattern, its large dorsal fin and its subcircular disc shape. The Common Stingaree (29.7), from eastern Australia, also has a dorsal fin but lacks dark markings on the upper surface.

COMMON STINGAREE

29.7

Trygonoptera testacea Müller & Henle, 1841

LC

IDENTIFICATION. Medium-sized, brownish stingaree with a subcircular disc, skirt-shaped nasal curtain, broad lobe at lateral border of nostril, rather long tail with a dorsal fin (sometimes evident as a low skin fold), and no lateral skin folds. Disc slightly wider than long; widest about 1–1.5 orbit lengths behind level of spiracles. Snout fleshy, tip sometimes weakly extended. Eyes medium-sized, orbit length 21–27% of snout length. Spiracle origin beneath about mid-eye or slightly anterior. Mouth small with 3–5 papillae on floor; teeth in upper jaw 17–23. Nasal curtain posterior angle not extended into distinct lobe; fringe prominent. Disc upper surface smooth. Tail slightly depressed (anteriorly) to oval in cross-section; rather elongate (83–96% disc length); dorsal fin small; caudal fin narrow and elongate, tip narrowly rounded.

COLOUR. Uniform brownish or greyish above, paler near edges. Caudal fin brownish or greyish, black in juveniles; extreme edge darkest. Dorsal fin greyish. Ventral surface white; disc margin sometimes dusky.

SIZE. To at least 52 cm TL (possibly to 61 cm TL); males mature at ~35 cm TL and females 41 cm TL; born at ~12 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off south-eastern Australia. Demersal in coastal waters; common on sand and reef habitats, but also ventures well upstream in estuaries, and offshore on soft bottoms to depths of ~60 m (rarely to 135 m). Produces litters of 2 pups, born in March or April. Diet consists mainly of polychaete worms and some crustaceans (shrimps); in smaller specimens, shrimps are dominant prey items.

SIMILAR SPECIES. Resembles the larger Eastern Shovelnose Stingaree (29.3) but has a dorsal fin (sometimes reduced to a small skin fold). These two species, which overlap in distribution in southern New South Wales, can be confused.

ORIENTAL STINGAREE

29.8

Urolophus aurantiacus Müller & Henle, 1841

NT

IDENTIFICATION. Small stingaree with a broadly oval disc, narrow skirt-shaped nasal curtain, broad internasal space, no lobe at anterior edge of nostril, rather long tail without skin folds, no dorsal fin, short caudal fin, and dorsal surface uniform greyish or brownish with a dark stripe along central tail in young. Disc wider than long, widest about an orbit length behind level of spiracles; less oval in adults than young. Head of medium length, ventral length ~30% TL; snout tip fleshy, barely extended. Eyes large, orbit length 28–36% of snout length. Spiracle origin below mid-eye. Mouth small, usually with 5 central oral papillae and a smaller papilla at each corner; teeth in upper jaw 31–44. Nasal curtain narrow anteriorly, broadly flared, posterior angle extended; fringe short; nostrils usually separated by 5.8% TL or less. Disc entirely smooth. Tail length usually 72–84% disc length, relatively robust before sting; caudal fin rather short and broad, tip rounded.

COLOUR. Disc variably plain greyish or brownish above, without dark markings or obvious blotches; tail similar to disc, often with broad and darker diffuse stripe on mid-tail; caudal fin and eyes usually darker than disc. Ventral surface white with broad greyish or brownish band along disc and pelvic-fin margins, less obvious in adults; tail usually with dark markings similar to disc margin.

SIZE. To ~40 cm TL; born at ~8 cm TL.

HABITAT AND BIOLOGY. North-West Pacific; southern Japan and Korea to Taiwan. Demersal on the outer continental shelf and upper continental slope, mainly at depths of 155–205 m but reportedly much shallower on rocky habitats. Produces small litters, generally only 1 or 2 pups.

SIMILAR SPECIES. Two genetic groupings of this species occur in the North-West Pacific (off Taiwan and Japan) and these need further investigation to assess their status.

SANDYBACK STINGAREE

29.9

Urolophus bucculentus Macleay, 1884

VU

IDENTIFICATION. Large stingaree with a broadly rhombic disc, wide rectangular nasal curtain and internasal space, no lobe at anterior edge of nostril, short tail with skin folds, a dorsal fin, and dorsal surface usually with a complex pattern of light flecks and reticulations. Disc much wider than long; widest at about half to an orbit length behind level of spiracles. Head medium-sized, ventral length ~34% TL; snout fleshy, tip weakly extended. Eyes small, orbit length 20–27% of snout length. Spiracle origin reaching about mid-eye. Mouth rather large with 14–16 papillae on floor; teeth in upper jaw 26–31. Nasal curtain broad, posterior angle barely extended; fringe short; nostrils separated by 7–8% TL. Disc entirely smooth. Tail strongly depressed, usually short (less than 73% disc length); caudal fin very short and broad.

COLOUR. Upper surface dark yellowish to brownish, usually with lighter flecks and/or fine reticulations. Caudal and dorsal fins brownish to black in young, paler greyish or brownish (sometimes mottled) in adults. Ventral surface white, sometimes with dark blotches on tail.

SIZE. To ~89 cm TL; males mature at ~40 cm TL and females at ~50 cm TL; born at ~17 cm TL.

HABITAT AND BIOLOGY. South-West Pacific, off south-eastern Australia (north to at least southern Queensland). Demersal, primarily temperate, on continental shelf and upper slope at depths of 65–265 m. Gives birth biennially to 1–5 pups after a 14–19 month gestation. Diet consists mainly of crustaceans.

SIMILAR SPECIES. Temperate relative of the Patchwork Stingaree (29.14), from which it largely differs in having a less striking, finely ornamented pattern on the dorsal disc (rather than a patchwork). Eastern Australian populations of the Patchwork Stingaree may be a variation of the Sandyback Stingaree.

CIRCULAR STINGAREE

29.10

Urolophus circularis McKay, 1966

LC

IDENTIFICATION. Large stingaree with a circular disc, skirt-shaped nasal curtain, narrow internasal space, no lobe at anterior edge of nostril, short tail without skin folds, a dorsal fin, short-lobed caudal fin, and dorsal surface covered with pale ring-like markings. Disc width about equal to length, widest at about two orbit lengths behind level of spiracles. Head of medium length, ventral length ~33% TL; snout tip fleshy, rarely extended. Eyes very large, orbit length ~40% of snout length. Spiracle very large, origin below mid-eye. Gill-slit margins highly irregular. Mouth medium-sized with ~10 papillae on floor; teeth in upper jaw ~40; chin with deep crenulate furrows. Nasal curtain broadly flared, posterior angle extended into long lobe; fringe weak; nostrils separated by ~6% TL. Disc entirely smooth. Tail short and robust, oval to rounded in cross-section, length less than 70% disc length; caudal fin rather short and broad, tip rounded.

COLOUR. Upper surface bluish to greyish, covered with light spots, blotches and rings; disc centre with ring of white-edged dark blue or grey spots. Caudal-fin margin and dorsal fin bluish or brownish. Ventral surface pale, pectoral margin not blackish nor sharply demarcated from rest of disc; tail usually pale dusky brown.

SIZE. To ~60 cm TL; smallest mature male ~53 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off south-western Australia. Cryptic inhabitant of rocky bottoms on continental shelf to depths of 120 m. Biology little known.

SIMILAR SPECIES. Resembles the Spotted Stingaree (29.15) which appears to be most abundant off south-eastern Australia. A ring of dark, white-edged spots on the disc (rather than clusters of small white spots) distinguishes these closely related species.

BANDED STINGAREE

29.11

Urolophus cruciatus (Lacépède, 1804)

LC

IDENTIFICATION. Medium-sized stingaree with a subcircular to oval disc, striking pattern of dark stripes and crossbars, skirt-shaped nasal curtain, short tail without lateral skin folds, no lobe at border of nostril nor a dorsal fin in adults. Disc oval or subcircular, slightly wider than long; widest at 1–2.5 orbit lengths behind level of spiracles (more posterior in young). Snout fleshy, tip not obviously extended. Eyes medium-sized, orbit length 25–28% of snout length. Spiracle origin beneath mid-eye. Mouth small with 3–6 papillae on floor; teeth in upper jaw 26–30. Nasal curtain posterior angle not extended into distinct lobe; fringe prominent. Disc upper surface entirely smooth. Tail before sting deep, circular to oval in cross-section; length variable, but usually short (63–84% disc length); dorsal fin sometimes present as a low skin fold in juveniles, always absent in adults; caudal fin very short, deep, tip broadly rounded to almost truncate.

COLOUR. Greyish to yellowish brown (rarely dark brown or black) above with a cross-like pattern of blackish bars and stripes; pattern usually consisting of a dark median stripe with irregular bars radiating laterally. Caudal fin plain greyish brown. Ventral surface mostly whitish; disc margin sometimes greyish and tail often blotched.

SIZE. To ~50 cm TL; males mature at ~22 cm TL and females at 20 cm TL; born at ~15 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off south-eastern Australia. Demersal on soft bottoms in bays and large estuaries, but also deeper on the continental shelf to 210 m depth. Often inactive, spending extended periods concealed by sediment. Litters of 1–4 pups produced biennially. Matures at about 6 years. Diet consists mainly of crustaceans (particularly isopods) and marine worms.

SIMILAR SPECIES. Resembles the Yellowback Stingaree (29.26) which has a more northerly distribution and lacks dark markings on its disc. The genetic structures of these rays are almost identical and further investigation is needed as they may be populations of a single species.

CHESTERFIELD STINGAREE

29.12

Urolophus deforgesi Séret & Last, 2003

LC

IDENTIFICATION. Small stingaree with a weakly rhombic disc, skirt-shaped nasal curtain, narrow internasal space, no lobe at anterior edge of nostril, long tail without skin folds, no dorsal fin, and dorsal surface uniform yellowish brown. Disc much wider than long; widest at more than 2 orbit lengths behind level of spiracles. Head short, ventral length mostly less than 30% TL; snout tip extended slightly. Eyes small, orbit length 27–32% of snout length. Spiracle origin beneath mid-eye. Mouth small with 7–8 papillae on floor; teeth in upper jaw 28–33. Nasal curtain small, posterior angle extended into distinct lobe; fringe prominent; nostrils separated by 5.5% TL or less. Disc entirely smooth. Tail slender, elongate (exceeding 75% disc length); caudal fin elongate, tip narrowly rounded.

COLOUR. Plain yellowish brown, without dark markings. Caudal fin margins dusky, most pronounced in young. Ventral surface whitish, disc margin often slightly darker but not conspicuously dark edged.

SIZE. To ~34 cm TL; a male specimen was mature at 28 cm TL; born at ~13 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Caledonia. Demersal on upper insular slopes, known from 203–330 m depths. Biology unknown.

SIMILAR SPECIES. Occurs together with the New Caledonian Stingaree (29.21) and Butterfly Stingaree (29.23) in the eastern Coral Sea, off the Chesterfield Islands. Unlike the Butterfly Stingaree it lacks a dorsal fin, and has a relatively narrower interorbital space than the New Caledonian Stingaree. The Coral Sea Stingaree, which occurs on the tropical eastern Australian continental slope, is closely related based on its genetic structure.

WIDE STINGAREE

29.13

Urolophus expansus McCulloch, 1916

LC

IDENTIFICATION. Medium-sized stingaree with a broadly rhombic disc in adults, subtle colour pattern of narrow bluish grey crossbars, skirt-shaped nasal curtain, rather long tail with prominent lateral skin folds, and lacking both a lobe at edge of nostril and a dorsal fin. Disc rhombic, more subcircular in young, much wider than long; widest at 1–1.5 orbit lengths behind level of spiracles. Snout fleshy, tip slightly extended and angular. Eyes rather large, orbit length 25–30% of snout length. Spiracle origin beneath about mid-eye. Mouth small with 6–9 papillae on floor; teeth in upper jaw 39–42. Nasal curtain posterior angle usually extended into short lobe; fringe weak. Disc upper surface entirely smooth. Tail before sting very depressed, moderately elongate (71–93% disc length); caudal fin elongate and slender, tip narrowly rounded or pointed.

COLOUR. Dorsal surface greyish green, usually with faint greyish blue crossbar posterior to eyes and similar oblique bar extending laterally from front of each eye; similar greyish blue blotches beside eyes and at insertion of pectoral fins. Caudal fin paler in adults than young. Ventral surface with dusky lateral margin; tail often with dark blotches.

SIZE. To ~52 cm TL; males mature at 30–36 cm TL and females at 40 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off south-western Australia. Demersal on soft bottoms of the upper continental slope and outer shelf, usually at depths of 130–420 m but sometimes shallower. Reaches maturity at about 7 years. Diet consists mainly of crustaceans and marine worms (polychaetes).

SIMILAR SPECIES. Resembles the Greenback Stingaree (29.27) but has a paler and relatively broader disc with a subtle colour pattern, rather than a narrower disc that is rich green and lacks distinct bars and blotches.

PATCHWORK STINGAREE

29.14

Urolophus flavomosaicus Last & Gomon, 1987

LC

IDENTIFICATION. Large stingaree with a broadly rhombic disc, wide rectangular nasal curtain and internasal space, no lobe at anterior edge of nostril, short tail with weak skin folds, a dorsal fin, and dorsal surface usually with a complex pattern of large white spots and reticulations. Disc much wider than long, widest at about an orbit length behind level of spiracles. Head medium-sized, ventral length 33–35% TL; snout fleshy, tip slightly extended. Eyes small, orbit length 19–28% of snout length. Spiracle origin reaching almost to mid-eye. Mouth rather large with 8–14 papillae on floor; teeth in upper jaw 24–31. Nasal curtain broad, posterior angle barely extended; fringe short; nostrils separated by 7–8% TL. Disc entirely smooth. Tail strongly depressed, usually short (67–79% disc length); caudal fin very short and broad.

COLOUR. Upper surface yellowish, central disc covered with pale spots surrounded by narrow yellowish rings and reticulations; spots rather regularly spaced, less obvious near disc margin. Caudal and dorsal fins usually pale yellowish, darker with black distal margins in newly born.

SIZE. To at least 59 cm TL; smallest adult males 38 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean (off Western Australia), and possibly South-West Pacific (off Queensland, eastern Australia). Demersal on the continental shelf and upper continental slope at depths of 60–320 m. Little known of its biology.

SIMILAR SPECIES. Resembles the Sandyback Stingaree (29.9), from temperate south-eastern Australia, with which it may overlap in distribution in southern Queensland. However, Queensland populations differ subtly in shape and coloration, often resembling the Sandyback Stingaree. More work is needed to confirm the existence of this stingaree in the Pacific Ocean.

SPOTTED STINGAREE

29.15

Urolophus gigas Scott, 1954

LC

IDENTIFICATION. Large stingaree with a circular disc, skirt-shaped nasal curtain, no lobe at anterior edge of nostril, moderately short tail without skin folds, a dorsal fin, short-lobed caudal fin, and blackish dorsal surface covered with a complex pattern of pale spots. Disc width about equal to length, widest at 1.5–4 orbit lengths behind level of spiracles. Head of medium length, ventral length 30–32% TL; snout tip fleshy, not extended. Eyes very small, orbit length 16–25% of snout length. Spiracle large, origin below mid- to posterior half of eye. Mouth small with 9–12 papillae on floor; teeth in upper jaw 35–43; chin with weak furrows. Gill-slit margins smooth. Nasal curtain narrow, weakly flared, posterior angle slightly extended; fringe well developed; nostrils usually separated by 5–6% TL. Disc entirely smooth. Tail rather short and robust, oval to round in cross-section, length 76–80% disc length; caudal fin short and broad, tip rounded.

COLOUR. Upper surface dark, almost entirely greyish black or more usually densely covered with pale spots; disc brownish towards its margin; 2 or 3 rows of spots around edge of disc extend onto tail; central disc with patches of larger creamish or white spots. Caudal and dorsal fins dark brown or black with margins pale. Ventral side pale, disc often with scattered dark blotches and broad, sharply defined, blackish lateral margins; tail with pale median stripe in small individuals.

SIZE. To ~80 cm TL; males and females mature at about 42 and 46 cm TL respectively.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off southern Australia. Demersal in inshore waters, usually shallower than 50 m depth; cryptic on both rocky and sandy bottoms, often lying concealed in seagrass or seaweed beds. Litters of up to 13 pups.

SIMILAR SPECIES. Closely resembles the Circular Stingaree (29.10) from Western Australia in body shape. These species differ primarily in eye and spiracle sizes, and colour pattern, and their distributions only overlap in a small part of their range in the Great Australian Bight.

JAVA STINGAREE

29.16

Urolophus javanicus (Martens, 1864)

CR

IDENTIFICATION. Small stingaree with a circular disc, strongly lobed nasal curtain, long snout, small eyes, rather broad internasal space, weak lobes on posterolateral border of nostrils, short tail without evidence of skin folds, large dorsal fin, and dorsal surface uniform yellowish brown. Disc very slightly longer than wide, widest more than 3 orbit lengths behind level of spiracles. Head short, ventral length ~30% TL; snout tip not extended. Eyes small, orbit length ~15% of snout length. Spiracle large, origin reaching forward of mid-eye. Mouth broad with ~10 very small papillae on floor; teeth in upper jaw ~30. Nasal curtain broad, posterior angle greatly extended into a broad lobe; fringe weak; nostrils separated by ~5.9% TL. Disc entirely smooth. Tail slender (~80% disc length); dorsal fin broadly rounded, slightly taller than upper lobe of caudal fin; caudal fin moderately elongate, tip broadly rounded.

COLOUR. Unknown when fresh and based on type specimen after long period of preservation. Dorsal side yellowish brown, appearing somewhat mottled and blotched (possibly an artefact of fixation); orbits and caudal fin not appreciably darker than rest of disc. Ventral surface of disc pale, broadly yellowish around disc margin and on edge of pelvic fin; tail darker than disc.

SIZE. Only known from 34 cm TL female type specimen.

HABITAT AND BIOLOGY. Western Central Pacific; Java Sea. Benthic, presumably on soft bottoms. Aspects of its natural history unknown, possibly collected inshore.

SIMILAR SPECIES. First collected in the mid 1800s and not seen again since. Placement in the genus *Urolophus* is provisional as it is unlike any other stingaree in the region with a very circular disc and an unusual nasal curtain. More specimens are needed to confirm its placement in this genus.

KAI STINGAREE 29.17

Urolophus kaianus Günther, 1880

DD

IDENTIFICATION. Small stingaree with a weakly rhombic disc, bell-shaped nasal curtain, narrow internasal space, no lobe at anterior edge of nostril, long tail without evidence of skin folds, no dorsal fin, and dorsal surface uniform brownish. Disc slightly wider than long, widest at slightly more than an orbit length behind level of spiracles. Head rather short, ventral length ~30% TL; snout tip barely extended. Eyes small, orbit length 28–35% of snout length. Spiracle origin almost reaching mid-eye. Mouth small with 7–10 papillae on floor. Nasal curtain small, posterior angle extended into a narrow pointed lobe; fringe prominent; nostrils separated by less than 5.5% TL. Disc entirely smooth. Tail slender, elongate (exceeding 90% disc length); caudal fin elongate, tip narrowly rounded.

COLOUR. Unknown when fresh. After long period of preservation, both types yellowish brown above; orbits much darker and strongly contrasted with rest of disc; caudal fin similar to tail, marginally paler around margin. Ventral surface whitish, disc margin not dark edged.

SIZE. Adult males to at least 23 cm TL, females probably larger.

HABITAT AND BIOLOGY. Western Central Pacific; off Kai Islands, Indonesia. Possibly with a restricted distribution on upper continental slopes. Types were collected at 230 m depth. Biology unknown.

SIMILAR SPECIES. Very poorly known, first collected in the late 1800s and not seen again since. In the general region, probably most similar in body shape to the Mitotic Stingaree (29.20). More specimens are needed.

KAPALA STINGAREE

29.18

Urolophus kapalensis Yearsley & Last, 2006

NT

IDENTIFICATION. Medium-sized stingaree with a subcircular to broadly rhombic disc, bell-shaped nasal curtain, no lobe at edge of nostril, rather long tail with prominent lateral skin folds, dorsal fin, and a greenish coloration with dark markings around the eyes. Disc wider than long, widest at 1–2 orbit lengths behind level of spiracles. Snout rather fleshy, obtuse, tip barely extended. Eyes small in adults, orbit length 22–29% of snout length. Spiracle origin usually forward of mid-eye. Mouth small with 5–7 papillae on floor; teeth in upper jaw 31–34. Nasal curtain posterior angle extended into short lobe; fringe weak. Disc upper surface entirely smooth. Tail before sting very depressed, relatively elongate (~85% disc length); caudal fin broad and elongate, tip narrowly rounded.

COLOUR. Uniform greenish above with a paler pinkish outer disc; dark blotches beneath each eye and a broad, v-shaped interorbital bar; additional large dark blotches above pelvic-fin bases; caudal fin dark in juveniles, pale greenish with a dark margin in adults. Ventral surface white with dusky lateral margins.

SIZE. To 52 cm TL; males mature at 31 cm TL; born at ~15 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off south-eastern Australia. Demersal on the continental shelf at depths of 10–130 m. Diet consists of shrimps, amphipods, and occasionally small bony fishes.

SIMILAR SPECIES. Resembles the Sparsely-spotted Stingaree (29.24) in body shape but always has a dorsal fin, lacks white spots on the dorsal side, and has a distinctive purplish pink disc margin; both species have an unusual nasal curtain that is distinctly bell-shaped. Most abundant off coastal New South Wales where it has been confused with the Common Stingaree (29.7).

LOBED STINGAREE

29.19

Urolophus lobatus McKay, 1966

LC

IDENTIFICATION. Small stingaree with a broadly oval to subcircular disc, skirt-shaped nasal curtain with large lobes anteriorly at edge of nostril, long tail with prominent lateral skin folds, no dorsal fin, and a plain yellowish brown coloration. Disc much wider than long, widest about an orbit length or less behind level of spiracles. Snout fleshy, tip slightly extended and angular. Eyes rather small in adults, orbit length 22–26% of snout length; relatively much larger in young. Spiracle origin beneath mid-eye. Mouth small with 9–10 papillae on floor; teeth in upper jaw 39–42. Nasal curtain posterior angle usually extended into angular lobe; fringe weak. Disc upper surface entirely smooth. Tail before sting very depressed, elongate (87–100% disc length); caudal fin rather narrow and elongate, tip broadly narrowly rounded to pointed.

COLOUR. Sandy brown above with slightly paler lateral margins, sometimes with slightly darker irregular blotches; tail occasionally with a narrow median stripe; caudal fin dark posteriorly, paler anteriorly. Ventral surface whitish, sometimes with darker blotches.

SIZE. To at least 43 cm TL; males mature at ~25 cm TL and females at 31 cm TL; born at ~17 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off south-western Australia. Demersal on the continental shelf to a depth of at least 30 m. Produces litters of 1 (occasionally 2) pups in October or November after a 10 month gestation. Diet consists mainly of crustaceans and small fishes.

SIMILAR SPECIES. Readily distinguished from all other stingarees by the prominent lobes on the front borders of the nasal curtain.

MITOTIC STINGAREE

29.20

Urolophus mitosis Last & Gomon, 1987

LC

IDENTIFICATION. Small stingaree with a subcircular to rhombic disc, skirt-shaped nasal curtain, long tail with weak lateral skin folds, no lobe at edge of nostril, no dorsal fin, and striking pattern of blotches and stripes each comprised of minute spots and streaks. Disc slightly wider than long, widest at about an orbit length behind level of spiracles. Snout thin, tip slightly extended and angular. Eyes large, orbit length 33–43% of snout length. Spiracle almost reaching mid-eye. Mouth rather large with 3–4 papillae on floor; teeth in upper jaw 27–28. Nasal curtain posterior angle knob-like, not usually forming a lobe; fringe weak. Disc upper surface entirely smooth. Tail before sting very depressed, moderately elongate (85–104% disc length); caudal fin elongate and slender, tip narrowly rounded.

COLOUR. Dorsal surface of disc with ornate pattern (blotches and bands) consisting of small, symmetrical, widely spaced clusters of small granular markings; pale green centrally, becoming reddish brown near its margin; markings pale blue, mostly variable in shape but regular in position. Ventral surface and caudal fin pale.

SIZE. To 33 cm TL; males mature at ~25 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; restricted to small area off north-western Australia. Demersal on mid- to outer continental shelf at depths of ~100–200 m. Little known of its biology.

SIMILAR SPECIES. Similar to the sympatric Brown Stingaree (29.28), but has larger eyes, a relatively longer tail, and the colour pattern is more ornate. No other stingaree has a distinctive pattern of fine spots and streaks in granular clusters resembling living cells in the process of mitotic division.

NEW CALEDONIAN STINGAREE 29.21

Urolophus neocaledoniensis Séret & Last, 2003

LC

IDENTIFICATION. Small stingaree with a subcircular disc, skirt-shaped nasal curtain, broad internasal space, no lobe at anterior edge of nostril, rather long tail sometimes with rudimentary skin folds, no dorsal fin, and dorsal surface uniform greyish brown to greenish brown. Disc wider than long, widest at more than an orbit length behind level of spiracles. Head of medium length, ventral length exceeding 30% TL; snout tip fleshy, barely extended. Eyes small, orbit length 25–27% of snout length. Spiracle origin below posterior half of eye. Mouth small with 7–10 papillae on floor; teeth in upper jaw 27–34. Nasal curtain broad, posterior angle not lobe-like; fringe weak; nostrils separated by 5.8% TL or more. Disc entirely smooth. Tail length 68–79% disc length, before sting relatively robust; caudal fin rather short and broad, tip rounded.

COLOUR. Plain greyish brown, without dark markings and often with a greenish tint; skin quite deciduous and often scraped with white scars on capture. Caudal fin margins dusky, most pronounced in young. Ventral surface whitish; dark bands around disc and pelvic-fin margins, extending posteriorly from level of mouth.

SIZE. To at least 37 cm TL; males mature at ~30 cm TL; born at ~13 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Caledonia. Demersal on upper continental slopes at depths of 230–430 m. Little known of its biology (or life history).

SIMILAR SPECIES. Occurs with the Chesterfield Stingaree (29.12) and Butterfly Stingaree (29.23) off the Chesterfield Islands (Coral Sea). Unlike the Butterfly Stingaree it lacks a dorsal fin, and it has a broader interorbit than the Chesterfield Stingaree.

COASTAL STINGAREE

29.22

Urolophus orarius Last & Gomon, 1987

EN

IDENTIFICATION. Small stingaree with a subcircular disc, slightly bell-shaped nasal curtain, no lobe at anterior of nostril, short tail without lateral skin folds, no dorsal fin, and a pattern of dark blotches on upper disc. Disc slightly wider than long, widest at ~1.5 orbit lengths behind level of spiracles. Snout fleshy, obtuse, tip rarely extended. Eyes large, orbit length 28–34% of snout length. Spiracle origin slightly to well forward of mid-eye; outer margin fleshy. Mouth small with 4–5 papillae on floor; teeth in upper jaw ~24. Nasal curtain posterior angle forming a knob; fringe weak. Disc upper surface entirely smooth. Tail before sting deep, circular to oval in cross-section, short (72–80% disc length); dorsal fin absent, even in juveniles; caudal fin short, slightly more elongate in young, tip broadly rounded.

COLOUR. Greyish brown above with blackish markings; obvious mask-like pattern around eyes with contrasting white spiracles; 3 enlarged blotches across middle of disc and 1 at base of each pelvic fin (most distinct in young and often faint in large adults); caudal and pelvic fins of juveniles dark. Ventral surface pale, margins greyish brown to black; lower surface of tail pigmented, mostly dark.

SIZE. To ~31 cm TL; males mature at ~23 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; southern Australia, restricted to small region near South Australian Gulfs. Demersal inshore and on continental shelf at depths of 5–50 m. Biology unknown.

SIMILAR SPECIES. Most closely related to the larger Banded (29.11) and Yellowback Stingarees (29.26) of temperate Australia, but distinguishable from these species by its distinctive colour pattern (blotched but without a dark pattern resembling a cross).

BUTTERFLY STINGAREE

29.23

Urolophus papilio Séret & Last, 2003

LC

IDENTIFICATION. Small to medium-sized stingaree with a broadly rhombic disc, rectangular nasal curtain, wide internasal space, no lobe at anterior edge of nostril, short tail sometimes with rudimentary folds, low dorsal fin, and dorsal surface uniformly yellowish or brownish. Disc much wider than long, widest 1–2 orbit lengths behind level of spiracles. Head large, ventral length exceeding 33% TL in adults; snout fleshy, tip weakly extended. Eyes of moderate size, orbit length 20–24% of snout length. Spiracle origin not reaching forward to mid-eye. Mouth small with 10–13 papillae on floor; teeth in upper jaw 24–28. Nasal curtain large, posterior angle not extended into lobe; fringe short; nostrils separated by 7% TL or more. Disc entirely smooth. Tail broad based, short (less than 70% disc length); caudal fin very short and broad.

COLOUR. Plain yellowish or brownish in adults, skin deciduous and often marked with pale scars on capture; young with distinct dark and light blotches. Margins of dorsal and caudal fins dusky, most pronounced in young. Ventral surface whitish, broad dark band around disc outer margin.

SIZE. Males to at least 31 cm TL, females probably much larger; born at ~14 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off New Caledonia. Demersal on upper continental slopes at depths of ~330 m. Biology unknown.

SIMILAR SPECIES. Occurs with the Chesterfield (29.12) and New Caledonian Stingarees (29.21) off the Chesterfield Islands, Coral Sea. No other members of the family found in the eastern Coral Sea have a dorsal fin.

SPARSELY-SPOTTED STINGAREE

29.24

Urolophus paucimaculatus Dixon, 1969

LC

IDENTIFICATION. Medium-sized stingaree with a broadly rhombic disc, bell-shaped nasal curtain, rather long tail with prominent lateral skin folds, no lobe at edge of nostril, no dorsal fin, and a plain greyish or greyish green coloration usually with sparsely arranged white spots. Disc wider than long, widest at about an orbit length behind level of spiracles. Snout rather fleshy, obtuse, tip barely extended. Eyes small, orbit length 22–28% of snout length. Spiracle origin forward of mid-eye. Mouth small with 5–6 papillae on floor; teeth in upper jaw 26–34. Nasal curtain posterior angle rarely extended into short lobe; fringe weak. Disc upper surface entirely smooth. Tail before sting very depressed, moderately elongate (77–98% disc length); caudal fin broad and elongate, tip narrowly rounded.

COLOUR. Uniformly pale grey to greyish green above, often with a variable number of small, regularly arranged, white spots (each encircled by a dark border). Caudal fin black in juveniles, more greyish with a narrow dark margin in adults. Ventral surface white, lateral margins of disc and pelvic fins dusky.

SIZE. To 57 cm TL; males mature at 27 cm TL and females ~25 cm TL; born at ~15 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; off southern Australia. Demersal on the continental shelf to depths of at least 150 m, but common in depths shallower than 10 m at southern limits of its distribution. Gives birth annually to 1–6 pups in November and December after an 11 month gestation. Males reach maturity at 3 years, females 5 years. Diet consists mainly of crustaceans and polychaete worms.

SIMILAR SPECIES. Populations from cool temperate Australia (Tasmania and Victoria) are typically white-spotted and most abundant inshore, shallower than 30 m. Populations at the western limits of their range usually lack white spots and occur more widely across the continental shelf, often deeper than 100 m.

CORAL SEA STINGAREE

29.25

Urolophus piperatus Séret & Last, 2003

LC

IDENTIFICATION. Small to medium-sized stingaree with a rhombic disc, skirt-shaped nasal curtain, rather wide internasal space, no lobe at anterior edge of nostril, long tail without skin folds, small dorsal fin, and dorsal surface with fine black spots. Disc much wider than long, widest at an orbit length or less behind level of spiracles. Head ventral length mostly exceeding 30% TL; snout angular, tip fleshy. Eyes small, orbit length 25–33% of snout length. Spiracle origin beneath mid-eye. Mouth small with 7–9 papillae on floor; teeth in upper jaw 32–35. Nasal curtain small, posterior angle extended into short, pointed lobe; fringe short; nostrils usually separated by 5.5% TL or more. Disc entirely smooth. Tail slender, elongate (exceeding 75% disc length); caudal fin short and broadly rounded.

COLOUR. Pale brown to greyish, usually with a sparse coverage of minute, dark brownish or black spots. Juveniles more strongly spotted, often with dense patch below orbit and a dark median stripe on upper tail. Dorsal fin pale brown, caudal fin with dark margin. Ventral surface whitish, disc margin dusky or mottled.

SIZE. To at least 48 cm TL; a 23 cm TL male was mature; young born at ~12 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off tropical eastern Australia. Demersal on outer continental shelf and upper slope at depths of 170–370 m. Biology unknown.

SIMILAR SPECIES. Resembles the Chesterfield Stingaree (29.12) in body shape which occurs further east in the Coral Sea, but has a more heavily spotted dorsal coloration and possesses a small dorsal fin (fin absent in the Chesterfield Stingaree).

YELLOWBACK STINGAREE

29.26

Urolophus sufflavus Whitley, 1929

VU

IDENTIFICATION. Medium-sized stingaree with a subcircular disc, skirt-shaped nasal curtain, short tail without lateral skin folds, no lobe at border of nostril, no dorsal fin, and plain yellowish dorsal coloration. Disc width equal to or slightly exceeding length, broadest part 1.5–2 orbit lengths behind level of spiracles. Snout fleshy, angle obtuse, tip not extended. Eyes medium-sized, orbit length 24–30% of snout length. Spiracle origin beneath mid-eye to slightly further forward. Mouth small with 3–4 papillae on floor; teeth in upper jaw 29–30. Nasal curtain posterior angle not extended into distinct lobe; fringe varying from weak to prominent. Disc upper surface entirely smooth. Tail before sting deep, circular to oval in cross-section; short (64–76% disc length); dorsal fin absent in juveniles and adults; caudal fin very short, deep, tip broadly rounded.

COLOUR. Plain yellowish brown above, sometimes with pinkish outer margin and/or a faint brownish stripe extending onto middle of tail. Caudal fin yellowish or brownish. Ventral surface white with pinkish margin; tail sometimes dark or with dark blotches.

SIZE. To ~42 cm TL; males mature at ~23 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off eastern Australia. Demersal on continental shelf and beyond shelf break at depths of 100–160 m. Little is known of its biology.

SIMILAR SPECIES. Genetically and morphologically similar to a more temperate inshore relative, the Banded Stingaree (29.11). The two species may hybridise off southern New South Wales where they display faint crossbar markings intermediate between the two colour forms. The validity of this species needs to be reassessed.

GREENBACK STINGAREE

29.27

Urolophus viridis McCulloch, 1916

VU

IDENTIFICATION. Medium-sized stingaree with a broadly rhombic disc, skirt-shaped nasal curtain, rather long tail with prominent lateral skin folds, no lobe at edge of nostril, no dorsal fin, and a plain greenish coloration. Disc wider than long, widest at about an orbit length behind level of spiracles. Snout fleshy, tip slightly extended and angular. Eyes large, orbit length 27–33% of snout length. Spiracle origin beneath mid-eye. Mouth small with 4–7 papillae on floor; teeth in upper jaw 28–32. Nasal curtain posterior angle usually extended into short lobe; fringe weak. Disc upper surface entirely smooth. Tail before sting very depressed, moderately elongate (75–93% disc length); caudal fin rather broad and elongate, tip rather narrowly rounded.

COLOUR. Dorsal surface of disc and tail uniformly greenish centrally, edges paler. Caudal-fin posterior margin dark in young, paler greenish brown in adults. Ventral surface of disc usually whitish with a purplish, brownish or pinkish margin; snout tip and undersurface of tail sometimes dark.

SIZE. To 51 cm TL; males mature at ~28 cm TL and females at 26–31 cm TL.

HABITAT AND BIOLOGY. South-West Pacific; off south-eastern Australia. Demersal on continental shelf and beyond shelf break, caught at 80–275 m depths and down to ~330 m. Produces litters of 1–3 pups that are born annually after a gestation of 10–12 months. Diet consists mainly of polychaete worms and crustaceans.

SIMILAR SPECIES. Resembles the Wide Stingaree (29.13) but has a narrower and more intensely green disc, and lacks a faint pattern of bluish grey crossbars.

BROWN STINGAREE

29.28

Urolophus westraliensis Last & Gomon, 1987

LC

IDENTIFICATION. Small stingaree with a rhombic disc, skirt-shaped nasal curtain, moderately elongate tail with poorly developed lateral skin folds, no lobe at edge of nostril, with or without a small dorsal fin, and usually a pale coloration with slightly darker crossbars. Disc slightly wider than long, widest at about an orbit length behind level of spiracles. Snout thin, tip slightly extended and angular. Eyes medium size, orbit length 22–28% of snout length. Spiracle origin slightly posterior of mid-eye. Mouth rather large with 5–6 papillae on floor; teeth in upper jaw 31–32. Nasal curtain posterior angle usually extended into short lobe; fringe very short. Disc upper surface entirely smooth. Tail before sting depressed slightly, 66–80% disc length; dorsal fin low or reduced to a small fold forward of sting; caudal fin rather broad and short, tip rather broadly rounded.

COLOUR. Uniformly yellowish to pale brown above, lacking spots but often with 3 indistinct dusky crossbars (across eyes, middle of gills and mid-disc); young pale yellowish; caudal fin yellow with a black margin. Ventral surface white.

SIZE. To at least 36 cm TL; males mature at ~24 cm TL; born at 10–13 cm TL.

HABITAT AND BIOLOGY. Eastern Indian Ocean; off north-western Australia. Demersal on continental shelf and beyond shelf break at depths of 60–220 m. Biology unknown.

SIMILAR SPECIES. Resembles the more temperate Wide Stingaree (29.13) in having faint crossbars on the upper disc but, unlike that species, the Brown Stingaree usually has a small dorsal fin (or short fleshy fold) on the tail before the sting. The geographic distributions of these species are well separated.

30

EAGLE RAYS

Family Myliobatidae

W.T. White & P.R. Last

Eagle rays are medium to very large rays (adults from 59 cm to at least 3 m DW) with a rhomboidal, 'wing-like' disc. A narrow head with laterally positioned eyes is elevated above the disc and protrudes forward anteriorly (usually more so in adults). The snout, typically short and rounded (rather than bilobed), is supported by the pectoral-fin skeleton rather than a rostral cartilage. Pectoral fins, which join the head laterally below the eye, have narrowly angular apices and angular free rear tips. The trunk is broad, depressed and thick. The mouth is broad and located ventrally, with plate-like teeth bands arranged in 6–10 (typically 7) rows in each jaw (middle row always broadest). Upper and lower tooth plates usually similar in shape, with lower plate not projecting forward of the mouth. Nasal curtain not distinctly notched, its rear margin nearly straight. The tail is much longer than the disc (when not damaged), filamentous distally, and lacks a caudal fin. One or more prominent, small barbed caudal stings are usually present (absent in all but 2 species of the genus *Aetomylaeus*). Stings are at the rear of a moderate-sized dorsal fin located near the tail base. The skin is often entirely smooth, but sometimes with minute denticles covering the dorsal surface; a few small thorns or tubercles may be present around eyes and along disc mid-line. The family is represented by 18 species in 2 genera: *Aetomylaeus* and *Myliobatis*. Due to their large average size, these rays are typically poorly represented in biological collections. Eagle rays are demersal and semi-pelagic, with a circumglobal distribution in temperate and tropical seas. Most species live near the coast and over inner continental and insular shelves, but have also been reported from the open ocean to depths of at least 422 m. May aggregate in large schools and some venture into brackish waters. They are viviparous (matrotrophic) with litters of 2–20 pups. Their powerful jaws and plate-like teeth enable them to grind up hard-shelled molluscs and crustaceans, as well as worms and small bony fishes. Caught mainly as bycatch in various tropical and temperate fisheries. Although rarely targeted, some species are used for human consumption or made into fish meal. Popular as displays in large aquaria and oceanaria.

KEY TO MYLIOBATID GENERA

1. Pectoral fins separate from rostral lobe, joining head at level of eye (fig. 1); caudal sting(s) absent in most species (present in *A. asperrimus* and *A. bovinus*); Eastern Atlantic and Indo–Pacific .... ***Aetomylaeus* (7 species; fig. 3, pp. 708–714)**

   Pectoral fins joined to the rostral lobe by a ridge below the eyes (fig. 2); caudal sting(s) always present; circumglobal ...... ***Myliobatis* (11 species; fig. 4, pp. 715–725)**

fig. 1

fig. 2

fig. 3

fig. 4

ROUGHSKIN EAGLE RAY

30.1

Aetomylaeus asperrimus (Gilbert, 1898)

DD

IDENTIFICATION. Small eagle ray with a brownish to greyish dorsal coloration with numerous whitish bands and spots, a moderately long fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and a small caudal sting behind dorsal fin. Disc very broad and short, about twice as wide as long. Pectoral fins weakly falcate, joining head below level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tip angular. Rostral lobe long and parabolic. Spiracles large, mostly lateral, barely visible in dorsal view. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc rough, with numerous stellate denticles. Tail elongate, whip-like, more than 3 times length of body, with numerous stellate denticles; dorsal fin small and raked back, apex broadly rounded, no free rear tip, its origin behind pelvic-fin free rear tips; caudal sting present (rudimentary in appearance in juveniles), situated well behind dorsal fin.

COLOUR. Dorsal surface brown or greyish; anterior portion of disc with 8–10 narrow, bluish white to white transverse bars which become broken into a series of spots towards outer margin of disc; posterior portion of disc with numerous whitish spots about size of pupil; tail black posteriorly. Ventral surface white.

SIZE. Attains at least 79 cm DW.

HABITAT AND BIOLOGY. Eastern Central Pacific; off Panama and Galapagos Islands. Very poorly known coastal species, primarily demersal on soft bottoms. Litter size unknown. Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Previously assigned to the genus *Pteromylaeus* but a recent taxonomic study placed this genus into the synonymy of *Aetomylaeus*. The Duckbill Eagle Ray (30.2), which is also now placed in this genus, has broader and less obvious transverse bars on the disc.

DUCKBILL EAGLE RAY

30.2

Aetomylaeus bovinus (Geoffroy St. Hilaire, 1817)

DD

IDENTIFICATION. Large eagle ray with a greenish to brownish dorsal coloration with broad bluish or whitish transverse bars, a moderately long fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and a caudal sting(s) behind dorsal fin. Disc very broad and short, length ~54% DW. Pectoral fins falcate, joining head below level of eye, separate from rostral lobe; posterior margins concave, free rear tip angular. Rostral lobe long and parabolic to somewhat pointed. Spiracles large, mostly lateral, barely visible in dorsal view. Small horn-like knob (or tubercle) present at anterior of each orbit in adult males. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 or 9 rows in each jaw; central row of teeth widest with 3 or 4 much smaller rows either side. Disc smooth in juveniles, becoming rough in larger specimens; denticles largest at mid-line of disc. Tail elongate, whip-like, ~2.4–2.5 times length of body, becoming rough in larger specimens; dorsal fin small and raked back, apex rounded to angular, no free rear tip, its origin above pelvic-fin free rear tips; 1 or 2 caudal stings present, situated just behind dorsal fin.

COLOUR. Dorsal surface greenish brown to brown in large specimens (brown, purplish or greenish in juveniles); disc with a series of bluish to white transverse bars (plain brown in adults). Ventral surface white.

SIZE. Attains ~220 cm DW (294 cm TL) and 116 kg. Males mature at 80–95 cm DW, females at 90–100 cm DW; born at 25–45 cm DW.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Spain to Mozambique, including the Mediterranean Sea. Coastal demersal, regularly entering estuaries and lagoons, from the surf zone to 150 m depth; often found in small groups of 3 or more individuals. Litters of 3–6 pups; gestation periods of 5–6 months (off Senegal) and 12 months (off South Africa). Diet consists of crabs, hermit crabs, gastropods, bivalves, squids and prawns.

SIMILAR SPECIES. Previously placed in the genus *Pteromylaeus* with the preceding species, but a recent taxonomic study placed this genus into the synonymy of *Aetomylaeus*.

BLUEBANDED EAGLE RAY

30.3

Aetomylaeus caeruleofasciatus White, Last & Baje, 2015

LC

IDENTIFICATION. Small eagle ray with a greyish brown dorsal coloration with up to 8 bluish transverse bars, a short fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and no caudal sting. Disc very broad and short (disc longer in adult females), length 55–67% DW. Pectoral fins weakly falcate, joining head below level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tip angular. Rostral lobe short and broadly rounded. Spiracles large, lateral, not visible in dorsal view. Small horn-like knob present on upper anterior margin of each orbit in adult males. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc smooth, without thorns or denticles. Tail elongate, whip-like, ~1.5–1.8 times length of body; dorsal fin small and raked back, apex somewhat angular, no free rear tip, its origin about level with pelvic-fin insertions; no caudal stings.

COLOUR. Dorsal surface greyish brown; disc with 5–8 broad, bluish (sometimes dark-edged) transverse bands beginning at the interorbital region; bands becoming faint in adults; faint banding present on tail. Ventral surface white.

SIZE. Attains ~59 cm DW. Males mature by at least 43 cm DW, females by at least 59 cm DW; born at 19–22 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and South-West Pacific; off northern Australia and southern New Guinea. Mainly pelagic in coastal and inner continental shelf habitats on soft bottoms at depths of 10–115 m. Litters of 4 pups (based on 1 pregnant female). Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Previously considered conspecific with the Banded Eagle Ray (30.6), but recently separated based on subtle morphological and meristic differences, as well as being genetically distinct.

MOTTLED EAGLE RAY

30.4

Aetomylaeus maculatus (Gray, 1834)

EN

IDENTIFICATION. Medium-sized eagle ray with a brownish to greenish brown dorsal coloration with numerous faint white spots mostly on posterior half of disc, a short fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and no caudal sting. Disc very broad and short (disc slightly longer in adult females), length 55–65% DW. Pectoral fins weakly falcate, joining head below level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tip angular. Rostral lobe short and moderately rounded. Spiracles large, lateral, not visible in dorsal view. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc smooth, without thorns or denticles. Tail very elongate, whip-like, ~3–4.4 times length of body; dorsal fin small and raked back, apex somewhat angular, no free rear tip, its origin just behind pelvic-fin insertions; no caudal stings.

COLOUR. Dorsal surface brownish to greenish brown; disc with numerous, usually faint, whitish spots mostly concentrated on the posterior half of disc; some pups with white transverse bars and ocelli on posterior half of disc. Ventral surface white.

SIZE. Attains at least 100 cm DW. Males mature by 71 cm DW, female size at maturity unknown; born at ~29 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and Western Pacific; Sri Lanka to Taiwan, eastern extent of range poorly defined. Pelagic, occurs over soft sandy bottoms and mostly coastal inshore to depths of ~60 m. Litter size unknown. Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Previously considered to be wide-ranging in the Indo–West Pacific, but recent taxonomic research has shown that the Western Indian Ocean population refers to the Ocellate Eagle Ray (30.5); the distributions of these 2 species needs to be investigated.

OCELLATE EAGLE RAY

30.5

Aetomylaeus milvus (Müller & Henle, 1841)

NE

IDENTIFICATION. Medium-sized eagle ray with a greenish brown dorsal coloration with numerous white spots mostly on posterior half of disc (sometimes forming bars and reticulations), a short fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and no caudal sting. Disc very broad and short, length 56–58% DW. Pectoral fins weakly falcate, joining head below level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tip angular. Rostral lobe short and narrowly rounded. Spiracles large, lateral, not visible in dorsal view. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc mostly smooth but with a short, distinct band of denticles on its anterior mid-line. Tail very elongate, whip-like, ~3.4–4.6 times length of body; dorsal fin small and raked back, apex somewhat angular, no free rear tip, its origin just behind pelvic-fin insertions; no caudal stings.

COLOUR. Dorsal surface greenish brown; disc with numerous whitish spots mostly concentrated on the posterior half of disc; spots often joining to form transverse bars and reticulations more anteriorly. Ventral surface white.

SIZE. Attains at least 123 cm DW; males mature by 69 cm DW; female size at maturity and size at birth unknown.

HABITAT AND BIOLOGY. Western Indian Ocean; Persian Gulf to India, eastern extent of range unclear. Poorly known, probably pelagic inshore over soft bottoms. Litter size unknown. Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Status of this species has been poorly defined but ongoing taxonomic research suggests it is distinct from and probably (at least in most part) not sympatric with the Mottled Eagle Ray (30.4); differs from the latter species in coloration and presence of a short but distinct denticle band on mid-line of disc.

BANDED EAGLE RAY

30.6

Aetomylaeus nichofii (Bloch & Schneider, 1801)

VU

IDENTIFICATION. Small eagle ray with a greyish brown dorsal coloration with up to 8 bluish transverse bars, a short fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and no caudal sting. Disc very broad and short (disc slightly longer in adult females), length 53–62% DW. Pectoral fins weakly falcate, joining head below level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tip angular. Rostral lobe short and broadly rounded. Spiracles large, lateral, not visible in dorsal view. Small horn-like knob present on upper anterior margin of each orbit in adult males. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc smooth, without thorns or denticles. Tail elongate, whip-like, ~1.4–1.8 times length of body; dorsal fin small and raked back, apex somewhat angular, no free rear tip, its origin about level with pelvic-fin insertions; no caudal stings.

COLOUR. Dorsal surface greyish brown; disc with 5–8 broad, bluish (sometimes dark-edged) transverse bands beginning at the interorbital region; bands becoming faint in adults; faint banding present on tail. Ventral surface white; pectoral-fin apices brownish.

SIZE. Attains ~72 cm DW; born at ~17 cm DW; males mature at 39–42 cm DW; female size at maturity unknown.

HABITAT AND BIOLOGY. Indo–West Pacific; Persian Gulf to southern Japan. Coastal and continental shelf, mainly pelagic over soft bottoms from inshore to at least 100 m depth. Litter size unknown. Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Previously considered to also be distributed in northern Australia and New Guinea but a recent study showed the latter records belong to a separate species, the Bluebanded Eagle Ray (30.3), which differs in subtle morphological and meristic differences, as well as being genetically distinct.

ORNATE EAGLE RAY

30.7

Aetomylaeus vespertilio (Bleeker, 1852)

EN

IDENTIFICATION. Very large eagle ray with a brown to bluish grey dorsal coloration with numerous black transverse lines anteriorly that form an open network posteriorly, very long fleshy rostral lobe joining head below level of eye (not joining with pectoral fins), and no caudal sting. Disc very broad but short, length about half DW. Pectoral fins weakly falcate, joining head below level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tip angular. Rostral lobe very long and rounded. Spiracles large, lateral, not visible in dorsal view. Mouth width much less than preoral length. Nasal curtain large with a curtain-like fringe, not deeply notched. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc mostly smooth, without thorns; adults with a narrow band of flat denticles along mid-line of disc and predorsal tail. Tail elongate, whip-like, ~3 times DW, with widely spaced granulations behind dorsal fin; dorsal fin small and raked back, apex somewhat angular, no free rear tip, its origin behind pelvic-fin insertions; no caudal stings.

COLOUR. Dorsal surface brown to bluish grey with black lines arranged transversely on anterior half of disc and forming an open network on posterior half of disc; head with several black spots and stripes; posterior margin of disc with white spots; tail mostly black. Ventral surface white.

SIZE. Attains at least 300 cm DW, possibly 350 cm DW (up to 600 cm TL); males mature at ~170 cm DW; female size at maturity unknown.

HABITAT AND BIOLOGY. Indo–West Pacific; known distribution patchy, from Mozambique and the Red Sea to northern Australia and southern China. Poorly known, mostly coastal, pelagic over coral reefs and inshore muddy bays to at least 110 m depth. Litter size unknown. Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Possibly confused with ocellated forms of the Mottled Eagle Ray (30.4) and the Ocellate Eagle Ray (30.5), but attains a much larger size and has a more complex colour pattern.

COMMON EAGLE RAY

30.8

Myliobatis aquila (Linnaeus, 1758)

DD

IDENTIFICATION. Medium-sized to large eagle ray with a plain dark coloration without spots or banding, a short fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and a large caudal sting(s) behind dorsal fin. Disc very broad and short, its length about half its width. Pectoral-fin anterior margins straight to weakly convex and posterior margins concave, origins below eyes, free rear tip angular. Rostral lobe short and broadly rounded. Small horn-like knob present on top of each orbit in adult males. Spiracles large, lateral, not visible in dorsal view. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~2–2.5 times DW when undamaged; dorsal fin small, broadly rounded with a short free rear tip, its origin well behind pelvic-fin rear tips; 1 or 2 long caudal stings.

COLOUR. Dorsal surface uniformly dark purplish brown to blackish, without other markings. Ventral surface mostly white; pectoral tips and posterior margin of disc usually brownish.

SIZE. Attains up to 150 cm DW (at least 260 cm TL), but mostly less than 83 cm DW. Males mature at ~32–40 cm DW, females 43–60 cm DW; birth size smaller than 19 cm DW.

HABITAT AND BIOLOGY. Eastern Atlantic and South-West Indian Ocean; Scotland to Kenya, including Mediterranean Sea. Mostly coastal demersal, preferring sandy and muddy bottoms of shallow bays, lagoons and estuaries; also to depths of at least 100 m. Litters of 3–7 pups after a 6–8 month gestation. Diet consists primarily of hard-shelled, bottom-dwelling invertebrates such as crabs and molluscs, but also polychaete worms; can be destructive to cultured bivalve beds.

SIMILAR SPECIES. It has been suggested that Mediterranean and South African populations may be separate species, but molecular barcoding does not support this claim.

BAT EAGLE RAY

30.9

Myliobatis californicus Gill, 1865

LC

IDENTIFICATION. Large eagle ray with a plain dark coloration without spots or banding, a short fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and a large caudal sting(s) behind dorsal fin. Disc broad but short, width less than twice length. Pectoral-fin anterior margins nearly straight and posterior margins slightly concave, apices rounded, origins below eyes, free rear tip angular. Rostral lobe margin short and broadly rounded. Spiracles large, lateral, not visible in dorsal view. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, more than 2 times disc length; dorsal fin small, broadly rounded with a short free rear tip, its origin over pelvic-fin rear tips; caudal sting present.

COLOUR. Dorsal surface uniformly dark brown, olive or blackish. Ventral surface mostly white, pectoral-fin tips darker. Albino specimens have been recorded.

SIZE. Attains ~180 cm DW, but rarely exceeds 150 cm DW. Males mature at ~62–66 cm DW, females 88–100 cm DW; born at 20–31 cm DW.

HABITAT AND BIOLOGY. Eastern Pacific; Oregon (USA) to Baja California (Mexico), and possibly Galapagos Islands. Inshore, mainly demersal on sandy and muddy bottoms, and around rocky reefs and kelp forests to at least 50 m depth; forms large mating aggregations during summer in some coastal bays. Litters of 2–12 pups, born in late spring and summer after 9–12 month gestation; litter size greatest in large individuals. Diet consists primarily of a variety of bottom-dwelling invertebrates, such as abalone, clams, gastropods, shrimps, polychaete worms, sea cucumbers, and rarely small bony fishes.

SIMILAR SPECIES. Sympatric with the Longnose Eagle Ray (30.14) for part of its range but differs in having a much shorter snout.

CHILEAN EAGLE RAY

30.10

Myliobatis chilensis Philippi, 1892

DD

IDENTIFICATION. Large eagle ray with a uniform dorsal surface without spots or banding, very short and broadly rounded fleshy rostral lobe joined to pectoral fins by a ridge below eyes, 9–16 tooth rows in jaws, and large caudal sting behind dorsal fin. Disc very broad and short. Pectoral-fin anterior margins weakly convex and posterior margins weakly concave, origins below eyes, free rear tip angular. Head and rostral lobe very short, and broadly rounded. Spiracles large, lateral, not visible in dorsal view. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 9–12 rows in the upper jaw and 11–16 rows in the lower jaw; central row of teeth similar-sized to adjacent rows or up to 3 times wider. Disc entirely smooth, without thorns or obvious denticles. Tail elongate, whip-like, about equal to length of disc; dorsal fin small, broadly rounded, short free rear tip present, its origin well behind pelvic-fin rear tips; a caudal sting present, located close to dorsal fin.

COLOUR. Dorsal surface uniform brown to reddish brown. Ventral surface of head and central disc white, and sharply demarcated from darker greyish brown pectoral fins; fringe of nasal curtain and nostrils often blackish.

SIZE. Attains 200 cm DW; size at birth and maturity unknown.

HABITAT AND BIOLOGY. South-East Pacific; central Peru to central Chile. Poorly known, demersal occurring from inshore to depths of 100 m; also found in open ocean. Litter size unknown. Diet unknown, but probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Inadequately described species requiring further taxonomic investigation; has more tooth rows than the sympatric Peruvian Eagle Ray (30.15), with its central row subequal in width to adjacent rows or slightly wider (*vs.* much wider).

BULLNOSE EAGLE RAY

30.11

Myliobatis freminvillei Lesueur, 1824

DD

IDENTIFICATION. Medium-sized eagle ray with a uniform purplish brown to greenish brown dorsal surface without spots or banding, a long fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and large caudal sting(s) behind dorsal fin. Disc very broad and short, length 57–63% DW. Pectoral-fin anterior margins nearly straight or weakly convex and posterior margins slightly concave, origins below eyes, free rear tip angular. Rostral lobe long and broadly rounded. Small horn-like knob present on top of each orbit in adult males. Spiracles large, lateral, not visible in dorsal view. Mouth much narrower than preoral length. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, usually with 7 rows in each jaw (rarely more or less than 7); central row of teeth widest, with 3 much smaller rows either side. Disc entirely smooth; larger specimens with a row of low denticles along anterior mid-line. Tail elongate, whip-like, ~2.3–2.5 times disc length when undamaged; dorsal fin small, broadly rounded, short free rear tip present, its origin just behind or level with pelvic-fin rear tips; 1 or 2 caudal stings present, longest about equal to interorbital distance, located close to dorsal fin.

COLOUR. Dorsal surface uniformly greyish, reddish brown or brown, without other markings. Ventral surface mostly white; pectoral fins dusky towards their tips.

SIZE. Attains at least 106 cm DW, but mostly less than 76 cm DW. Males mature at 60–70 cm DW; born at ~25 cm DW.

HABITAT AND BIOLOGY. Western Atlantic; Massachusetts (north-eastern USA) to northern Argentina. Coastal demersal, often entering estuaries. Off USA, migrates northwards in summer and southwards during winter. Litters of 6 pups. Diet consists of bivalves, gastropods and crustaceans.

SIMILAR SPECIES. Similar to the sympatric Southern Eagle Ray (30.12), but differs in having a larger dorsal fin that is situated further forward on the tail, narrower pectoral-fin tips, and 5th gill openings closer together.

SOUTHERN EAGLE RAY

30.12

Myliobatis goodei Garman, 1885

DD

IDENTIFICATION. Medium-sized eagle ray with a uniform dark brown to greyish brown dorsal surface without spots or banding, a short and pointed fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and a large caudal sting behind dorsal fin. Disc very broad and short, length 59–61% DW. Pectoral-fin anterior margins weakly convex and posterior margins moderately concave, origins below eyes, free rear tip angular. Rostral lobe short and pointed, extending laterally from level of eyes at junction with pectoral fins. Spiracles large, lateral, not visible in dorsal view. Mouth much narrower than preoral length. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like, thin and feeble, hexagonal, usually with 7–10 rows in each jaw; central row of teeth barely wider than those of lateral rows. Disc entirely smooth, without thorns or denticles. Tail elongate, whip-like, about twice disc length when undamaged; dorsal fin very small, broadly rounded, short free rear tip present, its origin well behind pelvic-fin rear tips; a caudal sting present, its length about equal to interorbital distance, located close to dorsal fin.

COLOUR. Dorsal surface uniformly dark brown to greyish brown, without other markings. Ventral surface whitish; pectoral fins dusky towards their tips.

SIZE. Attains at least 99 cm DW; size at birth unknown; males mature at ~45–55 cm DW and females at ~70 cm DW.

HABITAT AND BIOLOGY. Western Atlantic; South Carolina (USA) to Patagonia (Argentina). Poorly known, coastal, from nearshore to 180 m depth. Litters of 6 pups. Diet consists almost exclusively of polychaetes and soft invertebrates.

SIMILAR SPECIES. Similar to the sympatric Bullnose Eagle Ray (30.11) but differs in having a smaller dorsal fin that is situated further back on tail, pectoral-fin tips more broadly rounded, and 5th gill openings further apart. Similar also to the Shortnose Eagle Ray (30.16) but differs in having a broader head, narrower mouth, and thinner tooth plates.

PURPLE EAGLE RAY

30.13

Myliobatis hamlyni Ogilby, 1911

NT

IDENTIFICATION. Medium-sized eagle ray with a uniform dorsal surface without spots or banding, a short fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and a large caudal sting(s) behind dorsal fin. Disc very broad but short, length 57–62% DW. Pectoral-fin anterior margins nearly straight and posterior margins slightly concave, origins below eyes, free rear tip angular. Rostral lobe short and broadly rounded (slightly longer in adult males). A small horn-like knob present on top of each orbit in adult males. Spiracles large, lateral, not visible in dorsal view. Mouth narrower than preoral length. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~1.2–1.7 times DW when undamaged; dorsal fin small, broadly rounded, short free rear tip present, its origin behind pelvic-fin rear tips; 1 or 2 caudal stings present, longest greater than preoral length, located close to dorsal fin.

COLOUR. Dorsal surface uniformly purplish brown to greenish brown, without other markings. Ventral surface mostly white; pectoral tips and posterior margins of disc usually brownish.

SIZE. Attains at least 114 cm DW (more than 166 cm TL); born at less than 27 cm DW; males mature at ~65 cm DW.

HABITAT AND BIOLOGY. Eastern Indian Ocean and Western Pacific; known distribution patchy, Australia to Okinawa (Japan). Presumably demersal on continental and insular shelves and upper slopes at depths of 120–350 m. Litter size unknown. Diet unknown, but probably feeds on hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Once considered rare, and endemic to subtropical Australia. However, recent taxonomic investigations have revealed a much broader distribution in the Indo–West Pacific. Its range overlaps with shallow-water eagle rays, New Zealand Eagle Ray (30.17) and Japanese Eagle Ray (30.18).

LONGNOSE EAGLE RAY

30.14

Myliobatis longirostris Applegate & Fitch, 1964

NT

IDENTIFICATION. Medium-sized eagle ray with a uniform dark reddish brown dorsal surface without spots or banding, long fleshy rostral lobe joined to pectoral fins by a ridge below eyes, tubercles in row on back, and large caudal sting(s) behind dorsal fin. Disc very broad and short. Pectoral-fin anterior margins nearly straight and posterior margins moderately concave, origins below eyes, free rear tip angular. Rostral lobe long (much longer in adult males) and broadly rounded (tip pointed in adult males). Spiracles large, lateral, not visible in dorsal view. Small horn-like knob present on top of each orbit in adult males. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side; teeth of upper medial row strongly curved. Disc smooth, with median row of ~19 smooth tubercles. Tail elongate, whip-like, much longer than disc; dorsal fin small, broadly rounded, short free rear tip present, its origin well behind pelvic-fin rear tips; 1 or 2 caudal stings present, located close to dorsal fin.

COLOUR. Dorsal surface uniformly dark reddish brown, without other markings. Ventral surface whitish; pectoral and pelvic-fin tips darker.

SIZE. Attains at least 95 cm DW. Males mature at ~54 cm DW, females by 74 cm DW; size at birth unknown.

HABITAT AND BIOLOGY. Eastern Central Pacific; Mexico to Peru. Mostly coastal demersal on soft bottoms to depths of at least 65 m. Litter size unknown. Diet probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Resembles the Bullnose Eagle Ray (30.11) from the Western Atlantic, but differs in having a more elongate rostral lobe that is more pointed at its tip (in adult males) and medial teeth of upper jaw curved (*vs.* straight).

PERUVIAN EAGLE RAY

30.15

Myliobatis peruvianus Garman, 1913

DD

IDENTIFICATION. Large eagle ray with a uniform dorsal surface without spots or banding, short and broadly rounded fleshy rostral lobe joined to pectoral fins by a ridge below eyes, 7 tooth rows in jaws, and large caudal sting behind dorsal fin. Disc very broad and short. Pectoral-fin anterior margins straight and posterior margins concave, origins below eyes, free rear tip angular. Head extending well forward, rostral lobe short and broadly rounded. Spiracles large, lateral, not visible in dorsal view. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth very wide with 3 much smaller rows either side. Disc entirely smooth, without thorns or obvious denticles. Tail elongate, whip-like, longer than disc; dorsal fin small, broadly rounded, short free rear tip present, its origin behind pelvic-fin rear tips; a caudal sting present, located close to dorsal fin.

COLOUR. Dorsal surface uniform purplish brown to brown. Ventral surface of head and central disc white, with distal third of pectoral fins darkish to pale brown.

SIZE. Attains at least 131 cm DW.

HABITAT AND BIOLOGY. South-East Pacific; northern Peru to central Chile. Poorly known, presumably demersal, but most records from open ocean waters over the continental shelf and slope. Biology and diet very poorly known. Probably feeds on hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Overlaps in distribution with the Chilean Eagle Ray (30.10); these 2 species are very distinct at a molecular level and probably at a morphological level but key characters to separate these 2 species are poorly defined. The central tooth row is much wider than lateral rows in this species *vs.* much narrower or equal in width to the lateral rows in the Chilean Eagle Ray (30.10).

SHORTNOSE EAGLE RAY

30.16

Myliobatis ridens Ruocco, Lucifora, Díaz de Astarloa, Mabragaña & Delpiani, 2012

NE

IDENTIFICATION. Small eagle ray with a uniform dark dorsal surface without spots or banding, a short and broadly rounded fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and large caudal sting(s) behind dorsal fin. Disc very broad and short, length 58–64% DW. Pectoral-fin anterior margins weakly convex and posterior margins moderately concave, origins below eyes, free rear tip angular. Rostral lobe short and broadly rounded, not extending laterally from level of eyes at junction with pectoral fins. Spiracles large, lateral, not visible in dorsal view. Mouth width about equal to preoral length. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth massive, plate-like and hexagonal, usually with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc entirely smooth, without thorns or denticles. Tail elongate, whip-like, much longer than disc; dorsal fin small, broadly rounded, short free rear tip present, its origin well behind pelvic-fin rear tips; 1 or 2 caudal stings present, longest shorter than interorbital distance, located close to dorsal fin.

COLOUR. Dorsal surface uniformly dark brown, greenish brown or orange brown, without other markings. Ventral surface whitish; pectoral fins dusky towards their tips.

SIZE. Attains at least 70 cm DW; both sexes mature at 50–60 cm DW; size at birth unknown.

HABITAT AND BIOLOGY. Western Atlantic; Argentina, Uruguay and southern Brazil. Demersal, primarily in bay and estuarine habitats at depths of 5–45 m, mostly in less than 15 m depth. Litter size unknown. Diet probably consists mainly of hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Resembles the Southern Eagle Ray (30.12) but differs in having more robust tooth plates, shorter and more rounded rostral lobe that doesn't extend laterally from eyes, and a broader mouth.

NEW ZEALAND EAGLE RAY

30.17

Myliobatis tenuicaudatus Hector, 1877

LC

IDENTIFICATION. Large eagle ray with a faintly banded dorsal surface, a short fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and a caudal sting(s) behind dorsal fin. Disc very broad and short, length ~55–60% DW. Pectoral-fin anterior margins convex and posterior margins deeply concave, origins below eyes, free rear tip angular. Rostral lobe short and broadly rounded. Spiracles large, lateral, not visible in dorsal view. Mouth width narrower than preoral length. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal; mostly with 7 rows in each jaw (rarely up to 9 rows); central row of teeth widest with 3 (rarely 4) much smaller rows either side. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~1.3–1.7 times DW when undamaged; dorsal fin small, broadly rounded, short free rear tip present, its origin about level with pelvic-fin rear tips; 1–3 caudal stings present, longest subequal to preoral length, located close to dorsal fin.

COLOUR. Dorsal surface mostly olive green to yellowish (paler near margin of disc) with faint bluish spots and horizontal crescentic bars. Ventral surface pale, sometimes greyish along disc margin.

SIZE. Attains at least 160 cm DW (more than 300 cm TL). Males mature at ~65–69 cm DW, females at 80–100 cm DW; born at 20–30 cm DW.

HABITAT AND BIOLOGY. South-East Indian Ocean and South-West Pacific; southern Australia and New Zealand. Inshore, commonly off beaches, sand flats and seagrass beds; also offshore, to depths of 420 m (rarely deeper than 85 m). Adults migrate southwards during the warmer months. Litters of 2–20 (average 6) pups, born in summer months. Diet consists primarily of gastropods, bivalves, crustaceans and polychaete worms; creates feeding pits on the seabed in shallow water, which play an important role in maintaining the health of coastal ecosystems.

SIMILAR SPECIES. Until recently, considered to be endemic to New Zealand, but recent taxonomic investigation has revealed it to be a senior synonym of the temperate Australian Eagle Ray, *Myliobatis australis* Macleay.

JAPANESE EAGLE RAY

30.18

Myliobatis tobijei Bleeker, 1854

DD

IDENTIFICATION. Small eagle ray with a yellowish or olive brown dorsal surface, sometimes with darker markings, a short fleshy rostral lobe joined to pectoral fins by a ridge below eyes, and large caudal sting(s) behind dorsal fin. Disc very broad and short, length 59–65% DW. Pectoral-fin anterior margins slightly convex and posterior margins slightly concave, origins below eyes, free rear tip angular. Rostral lobe short and broadly rounded. Small horn-like knob present on top of each orbit in adult males. Spiracles large, lateral, not visible in dorsal view. Mouth width subequal to preoral length. Nasal curtain not deeply notched centrally, short and broad with a long fringe. Teeth plate-like and hexagonal, with 7 rows in each jaw; central row of teeth widest with 3 much smaller rows either side. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~1.1–1.5 times DW when undamaged; dorsal fin small, broadly rounded, short free rear tip present, its origin well behind pelvic-fin rear tips; 1 or 2 caudal stings present, longest much greater than preoral length, located close to dorsal fin.

COLOUR. Dorsal surface yellowish brown to olive brown, sometimes with irregularly shaped, darker brownish spots and blotches of varying sizes. Ventral surface mostly white; pectoral tips and posterior margins of disc usually dark brown.

SIZE. Attains at least 67 cm DW (more than 126 cm TL). Males mature at ~43 cm DW; size at birth smaller than 21 cm DW.

HABITAT AND BIOLOGY. North-West Pacific; central China to Russia (Sea of Okhotsk). Inshore demersal on sandy and muddy bottoms, primarily in coastal areas and large bays. Litters of at least 8 pups. Diet consists mostly of benthic fauna such as crabs, small fishes and clams.

SIMILAR SPECIES. Previously confused with the Purple Eagle Ray (30.13), but differs in having a relatively pale brown and sometimes spotted dorsal coloration (rather than being dark brown, without spots), and occurs at shallower depths.

31

PELAGIC EAGLE RAYS

Family Aetobatidae

W.T. White & P.R. Last

Pelagic eagle rays are large to very large rays (adults from 90 cm to at least 3 m DW, and possibly weighing 300 kg or more) with a rhomboidal, 'wing-like' disc. A narrow head with laterally positioned eyes is elevated above the disc and protrudes forward anteriorly. The short, rounded, single-lobed snout, supported by the pectoral-fin skeleton rather than a rostral cartilage, is somewhat flattened and projects well forward of the ventral head (more so in adults). Broad pectoral fins join the head laterally at level of eye, with their apices narrowly angular and free rear tips broadly rounded. The trunk is broad, depressed and thick. Mouth is broad, ventrally located, and lined with large patches of sensory pores and papillae. Teeth bands are arranged in a single row in each jaw and fused into hard plates. Upper tooth plate much broader than long, and the lower plate much longer than wide, projecting slightly forward of the mouth, and chevron-shaped. Nasal curtain with a deep, v-shaped notch. A narrow-based tail is much longer than the disc, filamentous distally and lacks a caudal fin. One or more prominent barbed caudal stings present near a moderate-sized dorsal fin, located near the tail base. The skin is often entirely smooth, but sometimes with minute denticles covering the dorsal surface. Members of the group, which is represented by 5 living species in a single genus (*Aetobatus*), are either plain coloured dorsally or variably covered with white spots or rings. Due to their often large size, these rays are typically poorly represented in biological collections. Traditionally classified together with the eagle rays (Myliobatidae), they have recently been separated into a different family based on molecular and morphological information. Pelagic eagle rays, which are primarily free-swimming in pelagic environments, have a circumglobal distribution in tropical and subtropical seas. They occur from the intertidal zone to well offshore, venturing into brackish habitats but not into freshwater. Viviparous (matrotrophic), with litters of up to 10 pups. Powerful jaw muscles and plate-like teeth form a grinding mill enabling them to feed on hard-shelled molluscs and crustaceans, as well as softer-bodied worms and small bony fishes. Caught mainly as bycatch in various tropical fisheries. Used for human consumption in some areas, discarded or made into fish meal. Desirable exhibits in large aquaria and oceanaria.

LONGHEAD EAGLE RAY

31.1

Aetobatus flagellum (Bloch & Schneider, 1801)

EN

IDENTIFICATION. Medium-sized eagle ray with a uniform brownish dorsal coloration without spots or rings, and a long rostral lobe. Disc very broad and short, length 55–70% DW. Pectoral fins weakly falcate, joining head at level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tips broadly rounded. Rostral lobe long (longest in adult males) and narrowly pointed. Spiracles large, dorsolateral, visible in dorsal view. Mouth located ventrally, its width narrower than preoral length. Nasal curtain large, deeply notched centrally, with a curtain-like fringe. Teeth plate-like, in a single row in each jaw; upper teeth transverse; lower teeth chevron-shaped. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~1.2–2.8 times DW when undamaged; dorsal fin small and raked back, apex broadly rounded, free rear tip short, its origin behind pelvic-fin insertions; 1 or 2 caudal stings, longest greater than preoral length.

COLOUR. Dorsal surface uniformly brownish to greenish brown, without other markings. Ventral surface mostly white; pectoral tips and posterior margins of disc usually pale brownish.

SIZE. Attains ~90 cm DW; size at birth unknown, smallest free-swimming individual 23 cm DW; males mature by ~50 cm DW and females by at least 75 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; from Persian Gulf to Borneo. Coastal habitats, associated with tropical and subtropical estuaries; known distribution patchy, and rarely captured. Litter size unknown. Diet unknown, but probably feeds on hard-shelled, bottom-dwelling invertebrates.

SIMILAR SPECIES. Previously thought to also occur in the North-West Pacific but this population was found to belong to another larger, plain-coloured species, the Naru Eagle Ray (31.4). The latter species differs from its smaller relative in size (attains ~150 *vs.* ~90 cm DW), coloration (mostly greenish grey rather than brownish), and in some morphological and meristic characteristics.

PACIFIC EAGLE RAY

31.2

Aetobatus laticeps Gill, 1865

NE

IDENTIFICATION. Large eagle ray with a bluish black dorsal coloration with numerous white spots or ocelli, and a moderately long fleshy rostral lobe. Disc very broad and short. Pectoral fins weakly falcate, joining head at level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tips broadly rounded. Rostral lobe moderately long and parabolic. Spiracles large, dorsolateral, visible in dorsal view. Mouth located ventrally, its width narrower than preoral length. Nasal curtain large, deeply notched centrally, with a curtain-like fringe. Teeth plate-like, in a single row in each jaw; upper teeth transverse; lower teeth chevron-shaped. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like; dorsal fin small and raked back, apex broadly rounded, free rear tip short; 1 or more caudal stings present.

COLOUR. Dorsal surface bluish black with numerous white spots or ocelli. Ventral surface mostly white.

SIZE. Attains at least 230 cm DW, usually less than 130 cm DW; size at birth and maturity not known.

HABITAT AND BIOLOGY. Eastern Pacific; from Gulf of California to Ecuador, including Galapagos Islands. Common species that occurs inshore, in coastal bays and estuaries, to well offshore; can be solitary or in large schools. Litter size unknown. Diet consists mainly of bivalves, but also shrimps, polychaetes and some fishes.

SIMILAR SPECIES. Previously considered conspecific with the Whitespotted Eagle Ray (31.3), but recent molecular, morphological and parasitic studies highlighted that they are separate species. Closer to, but distinct from, the Spotted Eagle Ray (31.5), which occurs in the Indo–West and Central Pacific. Further taxonomic investigation required to determine useful field characters to distinguish the species in this complex.

WHITESPOTTED EAGLE RAY

31.3

Aetobatus narinari (Euphrasen, 1790)

NT

IDENTIFICATION. Large eagle ray with a yellowish brown to greyish dorsal coloration with numerous white to bluish spots and a moderately long fleshy rostral lobe. Disc very broad and short, length 54–61% DW. Pectoral fins weakly falcate, joining head at level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tips broadly rounded. Rostral lobe moderately long (shorter in juveniles) and parabolic. Spiracles large, dorsolateral, visible in dorsal view. Mouth located ventrally, its width slightly narrower than preoral length. Nasal curtain large, deeply notched centrally, with a curtain-like fringe. Teeth plate-like, in a single row in each jaw; upper teeth transverse; lower teeth chevron-shaped. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~1.8–2.3 times DW when undamaged; dorsal fin small and raked back, apex broadly rounded, free rear tip short, its origin behind pelvic-fin insertions; 1 or 2 caudal stings, longest subequal to preoral length.

COLOUR. Dorsal surface usually brownish to olive brown with numerous white to pale bluish spots or small rings. Ventral surface mostly white, outer margins of pectoral fins brownish.

SIZE. Attains at least 230 cm DW, but mostly less than 140 cm DW; born at 18–36 cm DW; males mature at 127 cm DW; female size at maturity unknown.

HABITAT AND BIOLOGY. Western and probably Eastern Atlantic Ocean. Common in coastal habitats of the tropical and warm temperate seas to at least 60 m depth. Makes seasonal migrations, apparently in response to water temperatures. Litters of 4 pups. Diet consists of polychaetes, bivalves, gastropods, cephalopods, shrimps, and small fishes.

SIMILAR SPECIES. Previously thought to have a circumtropical distribution. However, recent taxonomic, parasite and molecular studies have revealed a complex of three very similar species, including the Spotted Eagle Ray (31.5) in the Indo–West Pacific, and the Pacific Eagle Ray (31.2) in the Eastern Pacific. A detailed taxonomic investigation of this complex is required.

NARU EAGLE RAY

31.4

Aetobatus narutobiei White, Furumitsu & Yamaguchi, 2013

NE

IDENTIFICATION. Large eagle ray with a uniform greenish grey dorsal coloration without spots or banding, and a long fleshy rostral lobe. Disc very broad and short, length 58–65% DW. Pectoral fins weakly falcate, joining head at level of eye, separate from rostral lobe; posterior margins slightly concave, free rear tips broadly rounded. Rostral lobe long (longer in adult males) and narrowly pointed. Spiracles large, dorsolateral, visible in dorsal view. Mouth located ventrally, its width narrower than preoral length. Nasal curtain large, deeply notched centrally, with a curtain-like fringe. Teeth plate-like, in a single row in each jaw; upper teeth transverse; lower teeth chevron-shaped. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~1.3–2 times DW when undamaged, shorter in juveniles; dorsal fin small and raked back, apex rounded, free rear tip short, its origin just behind pelvic-fin insertions; 1 or 2 caudal stings, longest subequal to preoral length.

COLOUR. Dorsal surface uniformly greenish grey (juveniles often brownish), sometimes with scattered darkish blotches but never white-spotted. Ventral surface mostly white; pectoral tips and posterior margins of disc brownish.

SIZE. Attains 150 cm DW; born at 33–35 cm DW; males mature by ~80 cm DW; female size at maturity unknown.

HABITAT AND BIOLOGY. North-West Pacific, from Vietnam to southern Japan. Common in coastal habitats over shallow tidal flats, offshore to at least 60 m depth. Schools move inshore in summer months in southern Japan, and retreat offshore into adjacent seas when temperatures drop below 15 °C. Litter size unknown. Diet consists mainly of hard-shelled bottom-dwelling invertebrates, in particular bivalves; considered a pest in parts of Japan due to its heavy predation on farmed bivalves.

SIMILAR SPECIES. Previously considered to be identical with the Longhead Eagle Ray (31.1), but recently distinguished from this species by its larger size (attains ~150 *vs.* ~90 cm DW), coloration (adults greenish grey *vs.* adults mostly brownish), and in some meristic and morphometric features.

SPOTTED EAGLE RAY

31.5

Aetobatus ocellatus (Kuhl, 1823)

VU

IDENTIFICATION. Very large eagle ray with a greenish, greyish or reddish brown dorsal coloration with numerous white to bluish spots (or sometimes ocelli), and a moderately long fleshy rostral lobe. Disc very broad and short, length 57–63% DW. Pectoral fins weakly falcate, joining head at level of eye, separate from rostral lobe; posterior margins moderately concave, free rear tips broadly rounded. Rostral lobe moderately long (shorter in juveniles) and parabolic. Spiracles large, dorsolateral, visible in dorsal view. Mouth located ventrally, its width slightly narrower than preoral length. Nasal curtain large, deeply notched centrally, with a curtain-like fringe. Teeth plate-like, in a single row in each jaw; upper teeth transverse; lower teeth chevron-shaped. Disc entirely smooth, without denticles or thorns. Tail elongate, whip-like, ~2.1–2.5 times DW when undamaged; dorsal fin small and raked back, apex broadly rounded, free rear tip short, its origin behind pelvic-fin insertions; usually 1 or 2 caudal stings (rarely up to 5), longest slightly shorter than preoral length.

COLOUR. Dorsal surface usually greenish grey (often pale) with numerous, similar-sized, whitish to pale bluish spots; some individuals with numerous white ocelli instead of spots, occasionally without spots or with spots confined to rear of disc. Ventral surface mostly white, outer anterior margin of disc dark.

SIZE. Attains 300 cm DW (880 cm TL); size at birth highly variable, from 18 cm DW to at least 50 cm DW; males mature at 100–130 cm DW and females at ~150–160 cm DW.

HABITAT AND BIOLOGY. Indo–Pacific, South Africa to Central Pacific Islands. Relatively common inshore (occasionally including estuaries), also well offshore. Produces litters of up to 10 pups, usually 4 or less. Diet consists primarily of hard-shelled bottom-dwelling invertebrates, such as hermit crabs, whelks, oysters, clams and other large molluscs.

SIMILAR SPECIES. Previously considered conspecific with the Whitespotted Eagle Ray (31.3) from the Western Atlantic, but recent molecular, morphological and parasitic studies highlighted that they are separate species. Populations in the Indo–West and Central Pacific may also be different species.

32

COWNOSE RAYS

Family Rhinopteridae

P.R. Last, W.T. White & C.M. Jones

Cownose rays are medium-sized to large rays (adults 90 cm to 1.7 m DW) with a broadly rhomboidal, 'wing-like' disc that is much wider than long. A distinctive, narrow head protrudes forward anteriorly well beyond eye level. Snout strongly indented anteriorly and has 2 large, fleshy cephalic-fin lobes in front of a fringed nasal curtain. The trunk is broad, depressed and thick. Eyes and spiracles are positioned laterally on the head. The mouth, which is located ventrally and almost as broad as the head, has plate-like teeth normally arranged in 7 (rarely 5 or 6) or more rows in each jaw. Pectoral fins originate below the spiracles. The tail, which is filamentous distally and lacks a caudal fin, is normally longer than the disc (although tail length varies among species, when undamaged). A small dorsal fin followed by 1 or more short serrated spines is located near the tail base. Skin is smooth or finely granular but lacks thorns or enlarged denticles. The family is represented by 8 living species in a single genus, *Rhinoptera*. These species are so morphologically similar that it is often difficult to distinguish among them. Additionally, due to their large size, adults are poorly represented in biological collections. Hence, their taxonomy is not well documented and a comprehensive revision of the family is needed. Cownose rays are mostly benthopelagic on continental shelves and near offshore islands, as well as in bays and estuaries, with a circumglobal distribution in tropical and warm temperate seas. They often occur in large aggregations and tend to be caught in batches, which appear irregularly in fish markets. Viviparous, but there is no placental connection between the mother and her young. Most species appear to produce a single young per pregnancy. These rays are opportunistic generalist feeders capable of using suction to ingest small prey or crushing hard-bodied shellfishes using their strong tooth plates. They are often taken as bycatch in tropical net fisheries and in some parts of their range they are used for human consumption. Cownose rays survive well in captivity and are prized exhibits in many large aquaria and oceanaria.

AMERICAN COWNOSE RAY

32.1

Rhinoptera bonasus (Mitchill, 1815)

NT

IDENTIFICATION. Large stocky cownose ray with a lozenge-shaped disc, moderately elongate whip-like tail (~1.1–1.4 times DW), dorsal-fin origin well behind pectoral-fin insertions, and central 3 rows of teeth in each jaw relatively narrow. Disc relatively broad and short, length 47–67% DW; anterior margin notched behind eye. Head relatively wide, ventral length ~24–27% DW, width across middle of eye 15–17% DW, width across posterior margin of spiracle 16–17% DW, internarial width 7–8.9% DW; snout moderately notched; cephalic lobes short, posterior edge barely reaching mouth, partly depressible into shallow groove. Spiracles larger than eye, originating slightly forward of pectoral-fin origins. Mouth narrow, 0.8–1.2 times preoral length. Teeth plate-like, 5–13 (usually 7) rows in each jaw; middle row much broader than those laterally, ~1.7–2.9 times wider than those adjacent; teeth of middle row of upper jaw thin, ~3–6 times wider than long, although this character seems to exhibit a great deal of variability. Pectoral-fin tips narrowly angular. Tail usually 2–2.3 times disc length; dorsal fin prominent, posterior margin weakly concave; caudal sting usually well-developed when present (often detached), longer than dorsal-fin base, its origin situated well posterior to dorsal-fin free rear tip; thick ventral skin fold on anterior tail.

COLOUR. Uniform dark brownish to greyish green above; upper surfaces of cephalic lobes often dark. Ventral surface largely white with broad dark greyish tips on pectoral fins. Tail base and skin fold on ventral surface white; its posterior half black.

SIZE. Attains ~110 cm DW; birth size 20–43 cm DW; males mature at 64–85 cm DW, females at 62–92 cm DW. Regional differences in maturity have been documented.

HABITAT AND BIOLOGY. Western Atlantic; New England (USA) to northern Argentina. Benthopelagic on continental and insular shelves, enters bays and estuaries. Occurs inshore in huge schools. Feeds primarily on benthic invertebrates, and implicated in damaging seagrass beds while feeding on molluscs.

SIMILAR SPECIES. Appears to co-occur with the Ticon Cownose Ray (32.2) throughout most of its range. Tooth row counts overlap but 7 rows is typical (rather than 9 for the Ticon Cownose Ray).

TICON COWNOSE RAY

32.2

Rhinoptera brasiliensis Müller, 1836

EN

IDENTIFICATION. Large cownose ray with a lozenge-shaped disc, short whip-like tail (0.4–1.1 times DW), broad mouth and internasal space, dorsal-fin origin near or slightly behind pectoral-fin insertions, and central 3 rows of teeth in each jaw short and broad. Disc short, length 52–66% DW; anterior margin barely notched behind eye. Head narrow, ventral length 25–27% DW, width across middle of eye 15–18% DW, width across posterior margin of spiracle 15–16% DW, internarial width 8.1–9.4% DW; snout moderately notched; cephalic lobes short, posterior edge reaching to or just beyond mouth, partly depressible into shallow groove. Spiracles larger than eye, originating slightly forward of pectoral-fin origins. Mouth broad, 1.1–1.2 times preoral length. Teeth plate-like, usually in 9 (varying from 7–15) rows in each jaw; in middle row of upper jaw ~5–8 times wider than long in adults, only slightly wider than those adjacent; remaining inner rows on each side much narrower. Pectoral-fin tips bluntly angular. Tail usually 1–1.7 times disc length in adults; dorsal fin well developed, origin before pelvic-fin insertions, posterior margin weakly convex to straight; undamaged caudal sting well developed, slightly longer than dorsal-fin base, its origin usually under dorsal-fin free rear tip.

COLOUR. Dark brown above. Ventral surface uniformly white, outer pectoral fins sometimes dusky.

SIZE. To at least 104 cm DW; males and females mature at ~78 cm DW; 38–48 cm DW at birth.

HABITAT AND BIOLOGY. Western Atlantic; Gulf of Mexico to southern Brazil. Benthopelagic, inshore over sandy bottoms, from nearshore to ~20 m depth. Southernmost population off Brazil has declined. Feeds largely on molluscs.

SIMILAR SPECIES. Co-occurs with the American Cownose Ray (32.1) throughout its range. Tooth row counts overlap but 9 rows is typical (rather than 7 for the American Cownose Ray). Genetic analyses indicate that this species is very closely related to the Pacific Cownose Ray (32.8) and to a lesser extent the Eastern Atlantic, Lusitanian Cownose Ray (32.5). More research is needed to resolve taxonomic issues within this family.

JAVAN COWNOSE RAY

32.3

Rhinoptera javanica Müller & Henle, 1841

VU

IDENTIFICATION. Very large, stocky cownose ray with a lozenge-shaped disc, long whip-like tail (~1.3–1.6 times DW), dorsal-fin origin well behind pectoral-fin insertions, and broad, short teeth in middle of each jaw. Disc broad and short, length 55–58% DW; anterior margin notched behind eye. Head small in adults, ventral length ~22–24% DW, width across middle of eye 13.5–15% DW, width across posterior margin of spiracle 14.7–15.9% DW, internarial width 7.4–8% DW; snout tip moderately notched; cephalic lobes short, posterior edge barely reaching mouth, partly depressible into shallow groove. Spiracles larger than eye, situated slightly behind pectoral-fin origins. Mouth width subequal to preoral length. Teeth plate-like, usually 7 rows in each jaw; 3 middle rows much broader than those laterally; middle row ~1.4–1.8 times wider than those adjacent; teeth of middle row of upper jaw very short, ~10–13 times wider than long. Pectoral-fin tips narrowly angular. Tail usually 2.4–3.4 times disc length; dorsal fin prominent, origin well behind pelvic-fin insertion, posterior margin mostly deeply concave; caudal sting short (often detached), about equal to or slightly shorter than dorsal-fin base, its origin situated well posterior to dorsal-fin free rear tip.

COLOUR. Uniform dark brownish, greenish brown or blackish above. Ventral surface whitish, outer half of pectoral fins usually greyish. Tail base white below, remainder of tail black.

SIZE. Attains at least 165 cm DW; females mature at ~128 cm DW, size at birth ~30 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; Oman to eastern Indonesia and Ryukyu Islands (southern Japan). Tropical benthopelagic, usually solitary or in small aggregations. Caught mainly by gill net fisheries.

SIMILAR SPECIES. Genetically similar to the Australian Cownose Ray (32.6) and the relationship between these forms needs further investigation. Appears to be more solitary than the Shorttail Cownose Ray (32.4) with which it coexists. *Rhinoptera adspersa* Müller & Henle is a likely synonym.

SHORTTAIL COWNOSE RAY

32.4

Rhinoptera jayakari Boulenger, 1895

NE

IDENTIFICATION. Large stocky cownose ray with a lozenge-shaped disc, short whip-like tail (~0.8–1.1 times DW), dorsal fin positioned well forward near pectoral-fin insertions, and relatively narrow teeth in middle of each jaw. Disc broad and long, length 58–64% DW; anterior margin notched behind eye. Head large, ventral length 24–26% DW, width across middle of eye 14.5–17.4% DW, width across posterior margin of spiracle 16.5–17.5% DW, internarial width 8.3–9.1% DW; snout tip deeply notched; cephalic lobes long, posterior edge usually extending past mouth almost to first gill slit, partly depressible into shallow groove. Spiracles much larger than exposed eye, situated slightly behind pectoral-fin origins. Mouth slightly wider than preoral length. Teeth plate-like, 9–11 rows in each jaw; 3 middle rows much broader than those laterally; middle row ~1.6–2.4 times wider than those adjacent; teeth of middle row of upper jaw ~5–8 times wider than long. Denticles in weak band on disc mid-line. Pectoral-fin tips narrowly angular. Tail short, usually 1.4–1.8 times disc length; dorsal fin prominent, origin over or slightly forward of pelvic-fin insertions, posterior margin straight to weakly convex; caudal sting short (often detached), usually slightly longer than dorsal-fin base, its origin beneath dorsal-fin inner margin.

COLOUR. Disc uniform dark brown, or greyish to bluish grey above; often paler on snout; ventral surface entirely white, usually with narrow black edge along pectoral fins. Tail base on undersurface white, rest of tail black.

SIZE. Attains ~90 cm DW; males mature at ~78 cm DW.

HABITAT AND BIOLOGY. Widespread in the Indo–West Pacific; South Africa to eastern Indonesia and Ryukyu Islands (southern Japan). Benthopelagic in the open ocean, often aggregating in large shoals.

SIMILAR SPECIES. May consist of 2 closely related species in the Indo–Pacific based on recent genetic findings. The forms possibly differ in the shape of the head and tail, and robustness of their bodies. *Rhinoptera sewelli* Misra is a likely synonym.

LUSITANIAN COWNOSE RAY

32.5

Rhinoptera marginata (Geoffroy St. Hilaire, 1817)

NT

IDENTIFICATION. Large cownose ray with a lozenge-shaped disc, short whip-like tail in adults (0.7–0.9 times DW), broad internasal space, dorsal-fin origin well behind pectoral-fin insertions, and central 3 rows of teeth in each jaw relatively broad. Disc broad and long, length 61–63% DW; anterior margin barely notched behind eye. Head wide, ventral length 24–27% DW, width across middle of eye ~20% DW, width across posterior margin of spiracle 18–23% DW, internarial width 9.2–11.4% DW; snout tip strongly notched; rostral lobes broad, posterior edge usually reaching beyond mouth, partly depressible into shallow groove. Spiracles much larger than eye, originating at pectoral-fin origins. Mouth broad, 1.4–1.9 times preoral length in adults. Teeth plate-like, 9–11 rows in each jaw; in middle row of upper jaw ~4–5 times wider than long, 1.3–1.8 times wider than those adjacent, much broader than adjacent teeth in adult males; central 5 rows relatively broad in females and young. Pectoral-fin tips bluntly angular. Tail usually 1.1–1.5 times disc length in adults, possibly up to 2.4 times in early young; dorsal fin small, origin usually slightly behind pelvic-fin insertions, posterior margin weakly concave; caudal sting usually well-developed when present (often detached), much longer than dorsal-fin base, its origin situated near dorsal-fin free rear tip; ventral skin fold on anterior tail obvious.

COLOUR. Brownish, greenish or bronze above. Ventral surface uniformly white, outer pectoral fins sometimes dusky. Tail darker, brownish to blackish.

SIZE. To at least 102 cm DW; size at birth ~23 cm DW; males mature at 72–77 cm DW, females ~80 cm DW.

HABITAT AND BIOLOGY. Eastern Atlantic; Congo to Portugal, including Mediterranean Sea. Benthopelagic, in large schools inshore on the continental shelf to ~100 m depth. Females appear to produce a single pup during each pregnancy.

SIMILAR SPECIES. Co-occurs in the Eastern Atlantic with the African Cownose Ray (32.7). Differs in having a broader oronasal region and typically shorter tail in adults. Based on genetic information, this species relates most closely to the Ticon Cownose Ray (32.2) from the Western Atlantic. Additional research is required to clear up taxonomic issues for this genus.

AUSTRALIAN COWNOSE RAY

32.6

Rhinoptera neglecta Ogilby, 1912

DD

IDENTIFICATION. Large stocky cownose ray with a lozenge-shaped disc, long whip-like tail (~1.9–2.1 times DW), dorsal-fin origin near pectoral-fin insertions, and short, broad teeth in middle of each jaw. Disc broad and short, length 58–64% DW; anterior margin of pectoral fin deeply notched behind eye. Head thick and broad, length ~17–19% DW, width across middle of eye 15–17% DW, width across posterior margin of spiracle 15–17% DW, internarial width 7.8–8.3% DW; snout deeply notched; cephalic lobes short, posterior edge usually reaching mouth, partly depressible into shallow groove. Spiracles larger than eye, situated above pectoral-fin origins. Mouth width subequal to preoral length. Teeth plate-like, 7–9 rows in each jaw; 3 middle rows much broader than those laterally; middle row ~1.2–1.9 times wider than those adjacent; teeth of middle row of upper jaw robust, ~4–7 times wider than long. Pectoral-fin tips narrowly angular. Tail elongate, usually 1.6–2.1 times disc length in adults (up to 3.4 in embryos); dorsal fin prominent, origin beside or just forward of pelvic-fin insertion, posterior margin upright; caudal sting short (often detached), about equal in length to dorsal-fin base, its origin usually behind rear tip of dorsal fin.

COLOUR. Disc uniform greyish brown to greyish green above, somewhat opalescent; upper rostral lobes dusky; ventral surface uniformly white. Tail dusky above and below.

SIZE. Attains at least 130 cm DW; size at birth ~31 cm DW.

HABITAT AND BIOLOGY. Western Central and South-West Pacific; Australia and Papua New Guinea. Benthopelagic, often in large schools over continental shelf but surprisingly rarely seen by fishermen or divers. Occasionally netted or stranded in aggregations on tidal mudflats off northern Queensland. Otherwise, aspects of its life history not well known.

SIMILAR SPECIES. Often confused with the Javan Cownose Ray (32.3) to which it is closely related based on genetic analyses. Specimens are needed to better characterise and compare this species with other Indo–Pacific cownose rays.

AFRICAN COWNOSE RAY

32.7

Rhinoptera peli Bleeker, 1863

NE

IDENTIFICATION. Possibly small cownose ray with a lozenge-shaped disc, long whip-like tail (~1.3 times DW), narrow internasal space, dorsal-fin origin well behind pectoral-fin insertions, and central 3 rows of teeth in each jaw relatively narrow. Disc broad and short, length 57–60% DW; anterior margin notched behind eye. Head wide, ventral length ~25% DW, width across middle of eye ~15% DW, width across posterior margin of spiracle 18–20% DW, internarial width 8.1–8.8% DW; snout moderately notched; cephalic lobes short and narrow, posterior edge just reaching mouth, partly depressible into shallow groove. Spiracles much larger than eye, originating at pectoral-fin origins. Mouth narrow, usually 1.2–1.3 times preoral length. Teeth plate-like, 7–9 (usually 7 rows) in each jaw; middle row distinctly broader than those laterally, ~1.4–2.2 times wider than those adjacent; teeth of middle row of upper jaw ~4–6 times wider than long. Pectoral-fin tips bluntly angular. Tail usually 2.2–2.3 times disc length; dorsal fin small, origin about over pelvic-fin insertions, posterior margin weakly concave; caudal sting usually well-developed when present (often detached), much longer than dorsal-fin base, its origin situated well posterior to dorsal-fin free rear tip; ventral skin fold on anterior tail deep.

COLOUR. Upper disc greyish pink with brown mucus, paler before and after eye. Ventral surface largely white, pectoral fins with narrow dark greyish tips. Tail pale brown to blackish.

SIZE. To at least 40 cm DW, based largely on museum specimens and certainly gets much larger.

HABITAT AND BIOLOGY. Eastern Central Atlantic; Mauritania to Liberia. Not well known, probably benthopelagic on the African continental shelf. Basic life history information needed.

SIMILAR SPECIES. Similar to the American Cownose Ray (32.1) from the Western Atlantic. Tentatively regarded as distinct from each other as the populations differ slightly in their genetics. Range overlaps with the Lusitanian Cownose Ray (32.5), and the two species appear to differ subtly in morphology.

PACIFIC COWNOSE RAY

32.8

Rhinoptera steindachneri Evermann & Jenkins, 1891

NT

IDENTIFICATION. Large cownose ray with a lozenge-shaped disc, rather short whip-like tail (0.8–1.1 times DW), narrow mouth and internasal space, dorsal-fin origin well behind pectoral-fin insertions, and central 3 rows of teeth in each jaw relatively broad. Disc broad and long, length 59–60% DW; anterior margin barely notched behind eye. Head narrow, ventral length ~25% DW, width across middle of eye 14–15% DW, width across posterior margin of spiracle ~16% DW, internarial width 6.6–7.4% DW; snout weakly notched; cephalic lobes broad, posterior edge usually reaching beyond mouth, partly depressible into shallow groove. Spiracles much larger than eye, originating at pectoral-fin origins. Mouth narrow, ~0.9 times preoral length. Teeth plate-like, in 7–9 rows in each jaw; in middle row of upper jaw ~3–4 times wider than long, about twice wider than those adjacent; 2 inner rows on each side narrow. Pectoral-fin tips bluntly angular. Tail usually 1.3–2 times disc length in adults; dorsal fin well developed, origin near or slightly behind pelvic-fin insertions, posterior margin weakly concave; undamaged caudal sting well developed, slightly longer than dorsal-fin base, its origin usually under dorsal-fin free rear tip; ventral skin fold on anterior tail not obvious.

COLOUR. Dark brown above, paler on head. Ventral surface uniformly white, outer pectoral fins sometimes dusky.

SIZE. To at least 104 cm DW; males and females mature at ~70 cm DW; 39–43 cm DW at birth.

HABITAT AND BIOLOGY. Eastern Central Pacific; northern Mexico to Peru, including Galapagos Islands. Benthopelagic in large aggregations inshore from tidal zone across inner continental shelf to ~65 m depth. Produces single pup after 10–12 month gestation.

SIMILAR SPECIES. Probably confined to the Eastern Pacific Ocean but specimens from the Gulf of Mexico, and identified as the Ticon Cownose Ray (32.2), are very similar based on genetic information. More comprehensive research is needed to resolve taxonomic issues within this genus.

33

DEVILRAYS

Family Mobulidae

W.T. White & P.R. Last

Devilrays are medium to very large rays (adults 1.1 m to at least 7 m DW) with a rhomboidal, 'wing-like' disc that is much broader than long. A broad head protrudes forward anteriorly beyond eye level with prominent cephalic lobes extending forward on each side. The trunk is broad, depressed and thick. Eyes and spiracles are positioned laterally. The mouth is very broad, either terminal or located ventrally (subterminal), with minute tooth bands in both jaws, or only in the lower jaw. The tail varies from long to relatively short, usually much less than width of the disc, with a small dorsal fin located near its base, and a small serrated caudal sting sometimes present. Skin sometimes rough but lacks thorns or enlarged denticles. The family is represented by 8 living species in a single genus, *Mobula*. Two species were previously assigned to the genus *Manta*, which differs from *Mobula* in having a terminal versus subterminal mouth; however, based on evidence from DNA analyses they should not be considered separate genera. Devilrays are poorly represented in biological collections due to their often very large size. They are mostly pelagic over continental shelves and near offshore islands, with a circumglobal distribution in tropical and warm temperate seas. Often found in small to very large groups and mostly observed swimming near the surface. Devilrays are viviparous (aplacental) with only a single pup per litter. They feed mostly on planktonic organisms sieved from the water using their highly modified branchial filter plates. Caught mainly as bycatch in various tropical net fisheries, but are targeted in some locations for their filter plates. In areas where they are fished, the flesh may be used for human consumption but often is discarded at sea or made into fishmeal. Devilrays are desirable exhibits in large aquaria and oceanaria and, in some countries, are becoming increasingly important for diving ecotourism.

REEF MANTA RAY

33.1

Mobula alfredi (Krefft, 1868)

VU

IDENTIFICATION. Large devilray with a very broad and terminal mouth, mostly black dorsal surface with white shoulder patches curving inwards from spiracles, small black spot emanating from fifth gill slits, no embedded caudal spine behind dorsal fin, and denticles not overlapping. Disc very broad and short, length 42–47% of width, anterior margins straight to slightly convex. Spiracles slit-like, on dorsal surface behind eyes. Mouth terminal, very broad 14–16% of disc width. Upper jaw without teeth or enlarged denticle bands; lower jaw with tooth band (54–77% of jaw width) containing 6–8 series of small, cusped teeth in 142–182 rows. Denticles on dorsal and ventral surfaces small, non-overlapping and uniformly distributed. Tail whip-like, ~1.2 times disc length when undamaged; dorsal fin small, triangular, not falcate; no spine or calcified lump behind dorsal fin.

COLOUR. Dorsal surface black; pale to white shoulder patches (sometimes with dark spots) present, their anterior margins curving inwards (not parallel with front of head). Ventral surface mostly whitish with variable dark markings often present (rarely mostly black); mouth pale to white; pale to dark blackish bands usually present on posterior margin of each pectoral fin; small black, semicircular spot emanating from the fifth gill slits.

SIZE. Attains ~550 cm DW; size at birth 130–150 cm DW; in South-West Indian Ocean, males mature at ~300 cm DW, females at ~390 cm DW.

HABITAT AND BIOLOGY. Circumtropical, apart from Eastern Pacific and Western Atlantic. Pelagic, mainly inshore around coral and rocky reefs, and areas associated with upwelling. Gestation period 12–13 months. Diet consists primarily of planktonic organisms and probably small bony fishes.

SIMILAR SPECIES. Only recently found to be a separate species from the Giant Manta Ray (33.2), from which it differs in coloration and absence of a calcified lump behind the dorsal fin.

GIANT MANTA RAY

33.2

Mobula birostris (Walbaum, 1792)

VU

IDENTIFICATION. Very large devilray with a very broad and terminal mouth, mostly black dorsal surface with white shoulder patches extending inwards from spiracles, medium to large black spot emanating from fifth gill slits, calcified lump present behind dorsal fin, and denticles dense and overlapping. Disc very broad and short, length 43–47% of width, anterior margins straight to slightly convex. Spiracles slit-like, on dorsal surface behind eyes. Mouth terminal, very broad, 16–17% of disc width. Upper jaw without teeth, but with 2 irregular bands of enlarged denticles; lower jaw with tooth band (65–70% of jaw width) containing 12–16 series of small, cusped teeth in 220–250 rows. Denticles on dorsal and ventral surfaces prominent, strongly overlapping and forming length-wise ridges. Tail whip-like; dorsal fin small, triangular, not falcate; a reduced caudal spine encased in a prominent calcified lump behind dorsal fin.

COLOUR. Dorsal surface black; pale to white shoulder patches (sometimes with dark spots) present, their anterior margins running parallel with the front of the head. Ventral surface mostly whitish with variable dark markings often present (rarely entirely black); mouth black to greyish; posterior third of disc grey to blackish; a medium to large black, semicircular spot emanating from the fifth gill slits.

SIZE. Attains at least 700 cm DW, possibly up to 910 cm DW; size at birth unknown; males mature at ~375–400 cm DW and females at 410–470 cm DW.

HABITAT AND BIOLOGY. Circumtropical, largely between latitudes 40° North and South. Pelagic, mostly along coastlines with regular upwelling, oceanic islands and offshore seamounts. Diet consists primarily of planktonic organisms and small bony fishes.

SIMILAR SPECIES. Closely resembles the Reef Manta Ray (33.1) but differs in coloration and presence of a calcified lump containing an embedded spine behind the dorsal fin.

ATLANTIC DEVILRAY

33.3

Mobula hypostoma (Bancroft, 1831)

DD

IDENTIFICATION. Small devilray with a broad and subterminal mouth, anterior margins of disc straight to slightly convex, spiracles circular and located below pectoral-fin origins, narrow tooth bands, no caudal spine, and dorsal fin usually without a white tip. Disc broad and short, length 50–60% of width. Distance between first gill slits ~12–14% of disc width. Spiracles circular, located below pectoral-fin origin. Mouth subterminal, broad, 11–14% of disc width. Upper and lower tooth bands less than 55% (mean 49% and 48% respectively) of mouth width; surface of crown smooth or crenulated on labial edge. Denticles absent in juveniles and widely spaced in adults. Branchial filter plates separate on gill arches, terminal lobe subcircular. Tail whip-like and long, ~1.5 times disc length; base of tail laterally compressed; dorsal fin small, apex broadly rounded, posterior margin concave; no caudal spine present.

COLOUR. Dorsal surface blackish brown to bluish black; anterior margin of head often darker; dorsal fin usually plain, without a prominent white tip. Ventral surface mostly greyish white.

SIZE. Attains at least 133 cm DW; born at ~55 cm DW; males mature by 109 cm DW and females by 111 cm DW.

HABITAT AND BIOLOGY. Western and Eastern Atlantic; North Carolina (USA) to northern Argentina, and Mauritania to Angola. Pelagic, mainly in coastal waters, but occasionally well offshore; forms large schools. Gestation period unknown. Diet consists of mainly planktonic crustaceans, but also small schooling fishes.

SIMILAR SPECIES. Eastern Atlantic populations were previously referred to as the Guinean Devilray *Mobula rochebrunei* (Vaillant) but recent taxonomic work has shown that this is a junior synonym of the Atlantic Devilray.

KUHL'S DEVILRAY

33.4

Mobula kuhlii (Müller & Henle 1841)

DD

IDENTIFICATION. Small devilray with a broad and subterminal mouth, anterior margins of disc straight to slightly convex, spiracles circular and located below pectoral-fin origins, wide tooth bands, base of tail quadrangular in cross-section, and no caudal spine present. Disc broad and short, length 50–59% of width. Spiracles very small, circular, located below pectoral-fin origin. Mouth subterminal, broad, 11–13% of disc width. Upper and lower tooth bands ~75% of mouth width; crown width greater than tooth height. Denticles mostly absent. Branchial filter plates greatly reduced, only 4–6 short, thick lateral lobes on plates, terminal lobe leaf-shaped and without ridges. Tail whip like and long, greater than disc width in embryos and juveniles, shorter than disc width in adults; dorsal fin small, apex broadly rounded, posterior margin shallowly concave; no caudal spine present.

COLOUR. Dorsal surface blackish to greyish brown; dorsal fin plain or with a white tip. Ventral surface mostly white.

SIZE. Attains at least 135 cm DW; born at 31–34 cm DW; males mature at ~115 cm DW and females by ~134 cm DW.

HABITAT AND BIOLOGY. Indo–West Pacific; South Africa to eastern Australia. Pelagic, mainly in coastal waters or inshore. Gestation period unknown. Diet unknown, presumably consisting mainly of planktonic organisms.

SIMILAR SPECIES. A long-headed form of this species was previously known as the Longhorn Devilray *Mobula eregoodootenkee* (Bleeker), but a recent taxonomic study suggested that rostral length is variable in some devilray species; these 2 forms are now considered to be conspecific, with *M. kuhlii* the valid name.

GIANT DEVILRAY

33.5

Mobula mobular (Bonnaterre, 1788)

EN

IDENTIFICATION. Large devilray with a broad and subterminal mouth, anterior margins of disc straight to slightly convex, spiracles slit like and located on dorsal surface of head, wide tooth bands, a serrated caudal spine usually present behind dorsal fin, and dorsal fin with prominent white tip. Disc broad and short, length 44–53% width. Spiracles slit-like (almost circular in newborns and embryos), located behind eyes on dorsal surface of head. Mouth subterminal, broad, 11–13% of disc width. Upper and lower tooth bands ~75% of mouth width; teeth well separated from each other, tooth height almost 3 times crown width. Denticles dense. Branchial filter plates separate on gill arches, 85–95 plates on each arch, 18–31 lobes on each plate, terminal lobe leaf-shaped with longitudinal ridges. Tail whip-like and very long, subequal to or exceeding disc width when undamaged; dorsal fin small, apex rounded, posterior margin concave; a short, serrated caudal spine typically present behind dorsal fin, covered by a black epithelium.

COLOUR. Dorsal surface bluish black; 2 crescentic white patches on shoulders, most obvious in embryos and juveniles, fading in adults; dorsal fin with a prominent white tip. Ventral surface white, sometimes with dark patches in adults.

SIZE. Attains at least 520 cm DW; born at ~90 cm DW (166 cm DW embryo reported from Mediterranean); males mature at 198–205 cm DW and females at around 236 cm DW.

HABITAT AND BIOLOGY. Probably circumglobal in warm seas. Pelagic, occurs both inshore and well offshore. Gestation period unknown. Diet consists mainly of planktonic crustaceans, as well as small bony fishes.

SIMILAR SPECIES. Previously considered to be distinct from the Japanese Devilray, *Mobula japanica* (Müller & Henle), but these forms are now considered conspecific, with *M. mobular* being the valid name.

PYGMY DEVILRAY

33.6

Mobula munkiana Notarbartolo-di-Sciara, 1987

NT

IDENTIFICATION. Small devilray with a broad and subterminal mouth, anterior margins of disc nearly straight, spiracles circular and located below pectoral-fin origins, rather wide tooth bands, and no caudal spine. Disc broad and short, length 55–62% of width. Spiracles circular, located below pectoral-fin origin. Mouth subterminal, broad, 11–13% of disc width. Upper and lower tooth-band width ~60% of mouth width; surface of crowns smooth. Denticles sparse on body surface. Branchial filter plates separate on gill arches, 50–60 plates on each arch, 9–15 lobes on each plate, terminal lobe circular to oval with a faint median longitudinal ridge. Tail whip-like and long, about equal to or greater than disc length; base laterally compressed; dorsal fin small, apex broadly rounded, posterior margin straight; no caudal spine present.

COLOUR. Dorsal surface dark purplish to purplish grey, with iridescent hues on side of head and pelvic region. Ventral surface mostly white; distal half of pectoral fins greyish.

SIZE. Attains 110 cm DW; born at ~35 cm DW; females mature by at least 97 cm DW and males by ~88 cm DW.

HABITAT AND BIOLOGY. Eastern Central Pacific; Gulf of California, Mexico to Peru, including Galapagos Islands. Pelagic, mainly in shallow coastal waters; forms large, highly mobile aggregations. Gestation period unknown. Diet poorly known; stomach contents of several specimens were dominated by mysid shrimps.

SIMILAR SPECIES. Possibly confused with the Bentfin Devilray (33.8) in some parts of its range. These species differ in the anterior disc profile (margin nearly straight in the Pygmy Devilray rather than distinctly concave) and the relative widths of their tooth bands.

CHILEAN DEVILRAY

33.7

Mobula tarapacana (Philippi, 1892)

DD

IDENTIFICATION. A medium-sized devilray with a broad and subterminal mouth, disc elongate and strongly falcate, spiracles slit-like and located above edge of disc, wide tooth bands, and no caudal spine. Disc elongate, with a long 'neck' and elongated pelvic area, length 57–67% of width, strongly falcate; a strong bony ridge present along dorsal mid-line; anterior margins straight near origin, then slightly concave and then convex towards the slender apex. Spiracles slit-like and elliptical, located above edge of disc. Mouth subterminal, broad, 11–14% of disc width. Upper and lower tooth-band width ~70% of mouth width; surface of crowns pitted with rounded concavities. Denticles densely cover most of the body surfaces, abrasive to touch. Branchial filter plates on gill arches fused together along their lateral margins, 50–69 plates on each arch, 13–22 lobes on each plate, terminal lobe circular with a short basal longitudinal ridge. Tail whip-like but short, slightly longer than disc in juveniles, much less than disc length in adults and rigid; an elongated depression present behind dorsal fin; dorsal fin small, apex broadly rounded, posterior margin straight; no caudal spine present.

COLOUR. Dorsal surface uniform greyish green to greyish brown. Dorsal fin plain, without a white tip. Ventral surface whitish anteriorly, pale greyish posteriorly.

SIZE. Attains at least 370 cm DW; born at 105–139 cm DW; males mature at 234–252 cm DW.

HABITAT AND BIOLOGY. Known distribution patchy but probably circumglobal in warm seas. Pelagic, relatively uncommon, occurs both in coastal inshore waters and well offshore. Gestation period unknown. Diet consists mainly of small fishes and, to a lesser extent, planktonic crustaceans.

SIMILAR SPECIES. A distinctive devilray that is distinguishable from other members of the family by its long and strongly falcate pectoral fins, strong bony ridge on the dorsal mid-line, and its uniform greyish coloration.

BENTFIN DEVILRAY

33.8

Mobula thurstoni (Lloyd, 1908)

NT

IDENTIFICATION. Small devilray with a broad and subterminal mouth, anterior margins of disc with distinct median concavity, spiracles circular and located below pectoral-fin origins, wide tooth bands, no caudal spine, and dorsal fin with a prominent white tip. Disc broad and short, length 50–61% of width, anterior margins straight near origin but with a distinctive median concavity. Spiracles circular, located below pectoral-fin origin. Mouth subterminal, broad, 12–14% of disc width. Upper and lower tooth-band widths more than 70% (~76 and 72% respectively) of mouth width; surface of crowns with coarse corrugations. Denticles very sparse on body surface. Branchial filter plates separate on gill arches, 70–75 plates on each arch, 15–20 lobes on each plate, terminal lobe leaf-shaped with a faint median longitudinal ridge sometimes present. Tail whip-like and long, ~60% of disc width in adults when intact; base dorsally depressed; dorsal fin small, apex broadly rounded, posterior margin slightly concave; no caudal spine present.

COLOUR. Dorsal surface dark bluish to black with purplish hues. Dorsal fin with a distinct white tip (becoming faint in adults). Ventral surface mostly white; distal half of pectoral fins silver; blackish margin along anterior disc becoming broad and very distinctive at level of concavity.

SIZE. Attains at least 189 cm DW; born at 65–85 cm DW; females mature by 154 cm DW and males by 150–154 cm DW.

HABITAT AND BIOLOGY. Known distribution patchy but probably circumglobal in warm seas. Pelagic, mainly in coastal waters, shallower than 100 m depth. Gestation period estimated to be 12 months. Diet highly specialised, prey dominated by euphausid and mysid shrimps.

SIMILAR SPECIES. Easily distinguishable from other small devilrays by a shallow concavity on the pectoral-fin anterior margins and a dorsally depressed tail base.

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*Technical papers preceded with an asterisk were prepared specifically for the book to describe new species and clarify taxonomic issues.

CHECKLIST OF THE WORLD'S RAYS

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
PRISTIDAE																					
8.1	*Anoxypristis cuspidata* (Latham, 1794)	Narrow Sawfish												X	X	X	X	X			0–40
8.2	*Pristis clavata* Garman, 1906	Dwarf Sawfish											X	X	X	X	X				0–40
8.3	*Pristis pectinata* Latham, 1794	Smalltooth Sawfish				X	X	X	X	X	X		X								0–90
8.4	*Pristis pristis* (Linnaeus, 1758)	Largetooth Sawfish		X	X	X	X				X		X	X	X	X	X				0–25
8.5	*Pristis zijsron* Bleeker, 1851	Green Sawfish											X	X	X	X	X				0–70
RHINIDAE																					
9.1	*Rhina ancylostoma* Bloch & Schneider, 1801	Shark Ray											X	X	X	X	X	X			1–70
9.2	*Rhynchobatus australiae* Whitley, 1939	Bottlenose Wedgefish											X	X	X	X	X	X			1–60
9.3	*Rhynchobatus cooki* Last, Kyne & Compagno, 2016	Roughnose Wedgefish															X				<40
9.4	*Rhynchobatus djiddensis* (Forsskål, 1775)	Whitespotted Wedgefish											X	X							1–70
9.5	*Rhynchobatus immaculatus* Last, Ho & Chen, 2013	Taiwanese Wedgefish																X			<100
9.6	*Rhynchobatus laevis* (Bloch & Schneider, 1801)	Smoothnose Wedgefish												X				X			<40
9.7	*Rhynchobatus luebberti* Ehrenbaum, 1915	African Wedgefish									X										1–35
9.8	*Rhynchobatus palpebratus* Compagno & Last, 2008	Eyebrow Wedgefish													X	X	X				5–60
9.9	*Rhynchobatus springeri* Compagno & Last, 2010	Broadnose Wedgefish												X	X		X				<40
9.10	*Rhynchorhina mauritaniensis* Séret & Naylor, 2016	False Shark Ray									X										<20
RHINOBATIDAE																					
10.1	*Acroteriobatus annulatus* (Müller & Henle, 1841)	Lesser Guitarfish										X	X								1–75
10.2	*Acroteriobatus blochii* (Müller & Henle, 1841)	Bluntnose Guitarfish										X									<40
10.3	*Acroteriobatus leucospilus* (Norman, 1926)	Greyspot Guitarfish											X								1–100
10.4	*Acroteriobatus ocellatus* (Norman, 1926)	Speckled Guitarfish											X								60–185
10.5	*Acroteriobatus omanensis* Last, Henderson & Naylor, 2016	Oman Guitarfish												X							<100
10.6	*Acroteriobatus salalah* (Randall & Compagno, 1995)	Salalah Guitarfish												X							<100
10.7	*Acroteriobatus variegatus* (Nair & Lal Mohan, 1973)	Stripenose Guitarfish												X							10–40
10.8	*Acroteriobatus zanzibarensis* (Norman, 1926)	Zanzibar Guitarfish											X								<100
10.9	*Pseudobatos glaucostigmus* (Jordan & Gilbert, 1883)	Greyspotted Guitarfish		X																	1–110
10.10	*Pseudobatos horkelii* (Müller & Henle, 1841)	Brazilian Guitarfish				X															1–150
10.11	*Pseudobatos lentiginosus* (Garman, 1880)	Freckled Guitarfish					X	X													1–30
10.12	*Pseudobatos leucorhynchus* (Günther, 1867)	Whitesnout Guitarfish		X																	1–50
10.13	*Pseudobatos percellens* (Walbaum, 1792)	Chola Guitarfish				X	X														1–110
10.14	*Pseudobatos planiceps* (Garman, 1880)	Pacific Guitarfish		X	X																<40

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
10.15	*Pseudobatos prahli* (Acero & Franke, 1995)	Gorgona Guitarfish		X																	1–70
10.16	*Pseudobatos productus* (Ayres, 1854)	Shovelnose Guitarfish	X	X																	1–90
10.17	*Rhinobatos albomaculatus* Norman, 1930	Whitespotted Guitarfish									X										1–35
10.18	*Rhinobatos annandalei* Norman, 1926	Bengal Guitarfish												X							<100
10.19	*Rhinobatos borneensis* Last, Séret & Naylor, 2016	Borneo Guitarfish															X				<100
10.20	*Rhinobatos holcorhynchus* Norman, 1922	Slender Guitarfish											X								75–350
10.21	*Rhinobatos hynnicephalus* Richardson, 1846	Ringed Guitarfish															X	X			<100
10.22	*Rhinobatos irvinei* Norman, 1931	Spineback Guitarfish									X										1–30
10.23	*Rhinobatos jimbaranensis* Last, White & Fahmi, 2006	Jimbaran Guitarfish													X						<100
10.24	*Rhinobatos lionotus* Norman, 1926	Smoothback Guitarfish												X							<100
10.25	*Rhinobatos nudidorsalis* Last, Compagno & Nakaya, 2004	Bareback Guitarfish											X								~125
10.26	*Rhinobatos penggali* Last, White & Fahmi, 2006	Indonesian Guitarfish													X						<100
10.27	*Rhinobatos punctifer* Compagno & Randall, 1987	Spotted Guitarfish												X							1–70
10.28	*Rhinobatos rhinobatos* (Linnaeus, 1758)	Common Guitarfish							X	X	X										1–90
10.29	*Rhinobatos sainsburyi* Last, 2004	Goldeneye Guitarfish													X		X				70–200
10.30	*Rhinobatos schlegelii* Müller & Henle, 1841	Bottlenose Guitarfish																X			1–200
10.31	*Rhinobatos whitei* Last, Corrigan & Naylor, 2014	Philippine Guitarfish																X			<100
GLAUCOSTEGIDAE																					
11.1	*Glaucostegus cemiculus* (Geoffroy St. Hilaire, 1817)	Blackchin Guitarfish							X	X	X										1–80
11.2	*Glaucostegus granulatus* (Cuvier, 1829)	Sharpnose Guitarfish												X							1–120
11.3	*Glaucostegus halavi* (Forsskål, 1775)	Halavi Guitarfish												X							0–100
11.4	*Glaucostegus obtusus* (Müller & Henle, 1841)	Widenose Guitarfish												X			X				1–60
11.5	*Glaucostegus thouin* (Anonymous, 1798)	Clubnose Guitarfish												X	X		X				1–60
11.6	*Glaucostegus typus* (Bennett, 1830)	Giant Guitarfish												X	X	X	X	X			0–100
TRYGONORRHINIDAE																					
12.1	*Aptychotrema rostrata* (Shaw, 1794)	Eastern Shovelnose Ray														X					1–220
12.2	*Aptychotrema timorensis* Last, 2004	Spotted Shovelnose Ray															X				~120
12.3	*Aptychotrema vincentiana* (Haacke, 1885)	Western Shovelnose Ray													X						0–125
12.4	*Trygonorrhina dumerilii* (Castelnau, 1873)	Southern Fiddler Ray													X	X					5–205
12.5	*Trygonorrhina fasciata* Müller & Henle, 1841	Eastern Fiddler Ray														X					1–100
12.6	*Zapteryx brevirostris* (Müller & Henle, 1841)	Shortnose Guitarfish				X															1–50
12.7	*Zapteryx exasperata* (Jordan & Gilbert, 1880)	Banded Guitarfish	X	X																	1–200

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
12.8	*Zapteryx xyster* Jordan & Evermann, 1896	Southern Banded Guitarfish		X																	1–150
PLATYRHINIDAE																					
13.1	*Platyrhina hyugaensis* Iwatsuki, Miyamoto & Nakaya, 2011	Hyuga Fanray																X			8–50
13.2	*Platyrhina psomadakisi* White & Last, 2016	Andaman Fanray												X							60–160
13.3	*Platyrhina sinensis* (Bloch & Schneider, 1801)	Chinese Fanray															X	X			<100
13.4	*Platyrhina tangi* Iwatsuki, Zhang & Nakaya, 2011	Yellowspotted Fanray															X	X			<100
13.5	*Platyrhinoidis triseriata* (Jordan & Gilbert, 1880)	Thornback Fanray	X	X																	1–135
ZANOBATIDAE																					
14.1	*Zanobatus maculatus* Séret, 2016	Marked Panray									X										<40
14.2	*Zanobatus schoenleinii* (Müller & Henle, 1841)	Striped Panray									X										1–40
NARCINIDAE																					
15.1	*Benthobatis kreffti* Rincon, Stehmann & Vooren, 2001	Krefft's Blind Numbfish				X															450–530
15.2	*Benthobatis marcida* Bean & Weed, 1909	Caribbean Blind Numbfish					X	X													250–1000
15.3	*Benthobatis moresbyi* Alcock, 1898	Indian Blind Numbfish												X							785–1070
15.4	*Benthobatis yangi* Carvalho, Compagno & Ebert, 2003	Yang's Blind Numbfish																X			~300
15.5	*Diplobatis colombiensis* Fechhelm & McEachran, 1984	Colombian Dwarf Numbfish					X														30–100
15.6	*Diplobatis guamachensis* Martin Salazar, 1957	Venezuelan Dwarf Numbfish					X														30–185
15.7	*Diplobatis ommata* (Jordan & Gilbert, 1890)	Pacific Dwarf Numbfish		X																	1–65
15.8	*Diplobatis picta* Palmer, 1950	Painted Dwarf Numbfish					X														1–130
15.9	*Discopyge castelloi* Menni, Rincon & Garcia, 2008	Castello's Apron Numbfish				X															35–55
15.10	*Discopyge tschudii* Heckel, 1846	Apron Numbfish			X	X															20–140
15.11	*Narcine atzi* Carvalho & Randall, 2003	Oman Numbfish												X							1–30
15.12	*Narcine baliensis* Carvalho & White, 2016	Indonesian Numbfish													X						<60
15.13	*Narcine bancroftii* (Griffith & Smith, 1834)	Caribbean Numbfish					X	X													1–35
15.14	*Narcine brasiliensis* (von Olfers, 1831)	Lesser Numbfish				X															10–20
15.15	*Narcine brevilabiata* Bessednov, 1966	Shortlip Numbfish												X			X	X			20–70
15.16	*Narcine entemedor* Jordan & Starks, 1895	Cortez Numbfish		X																	1–100
15.17	*Narcine insolita* Carvalho, Séret & Compagno, 2002	Madagascar Numbfish											X								150–175
15.18	*Narcine leoparda* Carvalho, 2001	Leopard Numbfish		X																	1–35

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
15.19	*Narcine lingula* Richardson, 1846	Chinese Numbfish												X			X	X			<100
15.20	*Narcine maculata* (Shaw, 1804)	Smallspot Numbfish												X			X	X			<100
15.21	*Narcine oculifera* Carvalho, Compagno & Mee, 2002	Bigeye Numbfish												X							1–25
15.22	*Narcine prodorsalis* Bessednov, 1966	Tonkin Numbfish												X			X	X			1–40
15.23	*Narcine rierai* (Lloris & Rucabado, 1991)	Mozambique Numbfish											X	X							170–500
15.24	*Narcine timlei* (Bloch & Schneider, 1801)	Brown Numbfish												X			X				<40
15.25	*Narcine vermiculata* Breder, 1928	Vermiculate Numbfish		X																	1–100
15.26	*Narcinops lasti* (Carvalho & Séret, 2002)	West Australian Numbfish													X						180–320
15.27	*Narcinops nelsoni* (Carvalho, 2008)	East Australian Numbfish														X					140–540
15.28	*Narcinops ornata* (Carvalho, 2008)	Ornate Numbfish													X		X				50–130
15.29	*Narcinops tasmaniensis* (Richardson, 1841)	Tasmanian Numbfish													X	X					1–640
15.30	*Narcinops westraliensis* (McKay, 1966)	Banded Numbfish													X						10–70
NARKIDAE																					
16.1	*Electrolux addisoni* Compagno & Heemstra, 2007	Ornate Sleeper Ray											X								2–50
16.2	*Heteronarce bentuviai* (Baranes & Randall, 1989)	Eilat Sleeper Ray												X							80–200
16.3	*Heteronarce garmani* Regan, 1921	Natal Sleeper Ray											X								70–330
16.4	*Heteronarce mollis* (Lloyd, 1907)	Soft Sleeper Ray												X							80–345
16.5	*Narke capensis* (Gmelin, 1789)	Cape Sleeper Ray										X	X								20–115
16.6	*Narke dipterygia* (Bloch & Schneider, 1801)	Spottail Sleeper Ray												X			X	X			1–100
16.7	*Narke japonica* (Temminck & Schlegel, 1850)	Japanese Sleeper Ray																X			1–100
16.8	*Temera hardwickii* Gray, 1831	Finless Sleeper Ray												X			X				<20
16.9	*Typhlonarke aysoni* (Hamilton, 1902)	Blind Sleeper Ray														X					50–800
HYPNIDAE																					
17.1	*Hypnos monopterygius* (Shaw, 1795)	Coffin Ray													X	X					1–220
TORPEDINIDAE																					
18.1	*Tetronarce californica* (Ayres, 1855)	Pacific Torpedo	X	X														X			3–275
18.2	*Tetronarce cowleyi* Ebert, Haas & Carvalho, 2015	South African Torpedo										X	X								110–455
18.3	*Tetronarce formosa* (Haas & Ebert, 2006)	Taiwanese Torpedo																X			1–300
18.4	*Tetronarce nobiliana* (Bonaparte, 1835)	Great Torpedo							X	X	X	X	X		X	X					1–925
18.5	*Tetronarce occidentalis* (Storer, 1843)	Western Atlantic Torpedo					X	X													1–530
18.6	*Tetronarce puelcha* (Lahille, 1926)	Argentine Torpedo				X															<500
18.7	*Tetronarce tokionis* (Tanaka, 1908)	Longtail Torpedo																X			220–1100

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
18.8	*Tetronarce tremens* (de Buen, 1959)	Chilean Torpedo		X	X																1–700
18.9	*Torpedo adenensis* Carvalho, Stehmann & Manilo, 2002	Aden Torpedo												X							25–140
18.10	*Torpedo andersoni* Bullis, 1962	Carribean Torpedo					X														10–230
18.11	*Torpedo bauchotae* Cadenat, Capapé & Desoutter, 1978	Rosette Torpedo								X											1–60
18.12	*Torpedo fuscomaculata* Peters, 1855	Blackspotted Torpedo										X	X	X							0–440
18.13	*Torpedo mackayana* Metzelaar, 1919	West African Torpedo									X										15–50
18.14	*Torpedo marmorata* Risso, 1810	Marbled Torpedo							X	X	X	X									1–370
18.15	*Torpedo panthera* von Olfers, 1831	Panther Torpedo												X							1–350
18.16	*Torpedo sinuspersici* von Olfers, 1831	Persian Gulf Torpedo											X	X							1–150
18.17	*Torpedo suessii* Steindachner, 1898	Red Sea Torpedo												X							?
18.18	*Torpedo torpedo* (Linnaeus, 1758)	Ocellate Torpedo							X	X	X										1–70
RAJIDAE																					
19.1	*Amblyraja doellojuradoi* (Pozzi, 1935)	Southern Thorny Skate			X	X															50–1000
19.2	*Amblyraja frerichsi* (Krefft, 1968)	Thickbody Skate			X	X															600–2200
19.3	*Amblyraja georgiana* (Norman, 1938)	Antarctic Starry Skate			X	X														X	20–1230
19.4	*Amblyraja hyperborea* (Collett, 1879)	Boreal Skate	X	X				X	X			X				X		X	X	X	300–2500
19.5	*Amblyraja jenseni* (Bigelow & Schroeder, 1950)	Jensen's Skate						X	X												165–2550
19.6	*Amblyraja radiata* (Donovan, 1808)	Thorny Skate						X	X										X		1–1400
19.7	*Amblyraja reversa* (Lloyd, 1906)	Reverse Skate												X							~1500
19.8	*Amblyraja taaf* (Meisner, 1987)	Whiteleg Skate										X								X	150–600
19.9	*Beringraja binoculata* (Girard, 1855)	Big Skate	X	X																	1–200
19.10	*Beringraja cortezensis* (McEachran & Miyake, 1988)	Cortez Skate		X																	~80
19.11	*Beringraja inornata* (Jordan & Gilbert, 1881)	California Skate	X	X																	15–670
19.12	*Beringraja pulchra* (Liu, 1932)	Mottled Skate																X			5–100
19.13	*Beringraja rhina* (Jordan & Gilbert, 1880)	Longnose Skate	X	X																	55–620
19.14	*Beringraja stellulata* (Jordan & Gilbert, 1880)	Pacific Starry Skate	X	X																	1–730
19.15	*Breviraja claramaculata* McEachran & Matheson, 1985	Brightspot Skate					X	X													295–895
19.16	*Breviraja colesi* Bigelow & Schroeder, 1948	Lightnose Skate					X														220–520
19.17	*Breviraja mouldi* McEachran & Matheson, 1995	Mould's Skate					X														365–775
19.18	*Breviraja nigriventralis* McEachran & Matheson, 1985	Blackbelly Skate					X														550–775
19.19	*Breviraja spinosa* Bigelow & Schroeder, 1950	Spinose Skate					X	X													365–670
19.20	*Dactylobatus armatus* Bean & Weed, 1909	Skillet Skate					X	X													340–685

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
19.21	*Dactylobatus clarkii* (Bigelow & Schroeder, 1958)	Hook Skate				X	X														315–915
19.22	*Dentiraja australis* (Macleay, 1884)	Sydney Skate														X					20–325
19.23	*Dentiraja cerva* (Whitley, 1939)	Whitespotted Skate													X	X					60–470
19.24	*Dentiraja confusa* (Last, 2008)	Australian Longnose Skate													X	X					20–390
19.25	*Dentiraja endeavouri* (Last, 2008)	Endeavour Skate														X					125–290
19.26	*Dentiraja falloarga* (Last, 2008)	False Argus Skate													X						120–255
19.27	*Dentiraja flindersi* Last & Gledhill, 2008	Pygmy Thornback Skate													X						25–55
19.28	*Dentiraja healdi* (Last, White & Pogonoski, 2008)	Heald's Skate													X						305–520
19.29	*Dentiraja lemprieri* (Richardson, 1845)	Australian Thornback Skate													X	X					1–170
19.30	*Dentiraja oculata* (Last, 2008)	Australian Ocellate Skate													X						200–390
19.31	*Dentiraja polyommata* (Ogilby, 1910)	Argus Skate														X					135–320
19.32	*Dipturus acrobelus* Last, White & Pogonoski, 2008	Australian Deepwater Skate													X	X					450–1330
19.33	*Dipturus amphispinus* Last & Alava, 2013	Ridgeback Skate															X				?
19.34	*Dipturus apricus* Last, White & Pogonoski, 2008	Pale Tropical Skate														X					195–605
19.35	*Dipturus batis* (Linnaeus, 1758)	Common Blue Skate							X												1–1500
19.36	*Dipturus bullisi* (Bigelow & Schroeder, 1962)	Tortugas Skate					X														185–550
19.37	*Dipturus campbelli* (Wallace, 1967)	Blackspot Skate											X								135–405
19.38	*Dipturus canutus* Last, 2008	Grey Skate													X	X					155–1050
19.39	*Dipturus chinensis* (Basilewsky, 1855)	Polkadot Skate																X			20–80
19.40	*Dipturus crosnieri* (Séret, 1989)	Madagascar Skate											X								300–850
19.41	*Dipturus doutrei* (Cadenat, 1960)	Javelin Skate									X	X									165–1200
19.42	*Dipturus ecuadoriensis* (Beebe & Tee-Van, 1941)	Ecuador Skate		X																	?
19.43	*Dipturus garricki* (Bigelow & Schroeder, 1958)	San Blas Skate					X														275–475
19.44	*Dipturus gigas* (Ishiyama, 1958)	Giant Skate																X			300–1000
19.45	*Dipturus grahami* Last, 2008	Graham's Skate														X					145–490
19.46	*Dipturus gudgeri* (Whitley, 1940)	Bight Skate													X	X					160–765
19.47	*Dipturus innominatus* (Garrick & Paul, 1974)	New Zealand Smooth Skate														X					1–1300
19.48	*Dipturus intermedius* (Parnell, 1837)	Flapper Skate							X												1–600
19.49	*Dipturus johannisdavisi* (Alcock, 1899)	Travancore Skate												X							375–550
19.50	*Dipturus kwangtungensis* (Chu, 1960)	Kwangtung Skate															X	X			?
19.51	*Dipturus laevis* (Mitchill, 1818)	Barndoor Skate						X													10–790

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
19.52	*Dipturus lanceorostratus* (Wallace, 1967)	Rattail Skate											X								430–440
19.53	*Dipturus leptocaudus* (Krefft & Stehmann, 1975)	Thintail Skate				X															400–550
19.54	*Dipturus macrocaudus* (Ishiyama, 1955)	Bigtail Skate																X			300–400
19.55	*Dipturus melanospilus* Last, White & Pogonoski, 2008	Blacktip Skate														X					240–695
19.56	*Dipturus mennii* Gomes & Paragó, 2001	Menni's Skate				X															~480
19.57	*Dipturus nidarosiensis* (Storm, 1881)	Norwegian Skate							X		X	X									140–1235
19.58	*Dipturus olseni* (Bigelow & Schroeder, 1951)	Spreadfin Skate					X														55–385
19.59	*Dipturus oregoni* (Bigelow & Schroeder, 1958)	Hooktail Skate					X														475–1080
19.60	*Dipturus oxyrinchus* (Linnaeus, 1758)	Sharpnose Skate							X	X	X										90–900
19.61	*Dipturus pullopunctatus* (Smith, 1964)	Slime Skate										X	X								30–385
19.62	*Dipturus queenslandicus* Last, White & Pogonoski, 2008	Queensland Deepwater Skate														X					400–605
19.63	*Dipturus springeri* (Wallace, 1967)	Roughbelly Skate										X	X	X							50–970
19.64	*Dipturus stenorhynchus* (Wallace, 1967)	Prownose Skate											X								255–760
19.65	*Dipturus teevani* (Bigelow & Schroeder, 1951)	Caribbean Skate				X	X	X													320–730
19.66	*Dipturus tengu* (Jordan & Fowler, 1903)	Acutenose Skate															X	X			60–150
19.67	*Dipturus trachydermus* (Krefft & Stehmann, 1975)	Roughskin Skate			X	X															20–480
19.68	*Dipturus wengi* Séret & Last, 2008	Weng's Skate													X	X					485–1165
19.69	*Dipturus wuhanlingi* Jeong & Nakabo, 2008	China Skate																X			?
19.70	*Hongeo koreana* (Jeong & Nakabo, 1997)	Korean Skate																X			30–80
19.71	*Leucoraja circularis* (Couch, 1838)	Sandy Skate							X	X	X										50–800
19.72	*Leucoraja compagnoi* (Stehmann, 1995)	Tigertail Skate										X	X								480–625
19.73	*Leucoraja erinacea* (Mitchell, 1825)	Little Skate						X													10–915
19.74	*Leucoraja fullonica* (Linnaeus, 1758)	Shagreen Skate							X	X									X		30–600
19.75	*Leucoraja garmani* (Whitley, 1939)	Rosette Skate					X	X													35–530
19.76	*Leucoraja lentiginosa* (Bigelow & Schroeder, 1951)	Freckle Skate					X														55–590
19.77	*Leucoraja leucosticta* (Stehmann, 1971)	Whitedapple Skate									X										70–600
19.78	*Leucoraja melitensis* (Clark, 1926)	Maltese Skate								X											60–800
19.79	*Leucoraja naevus* (Müller & Henle, 1841)	Cuckoo Skate							X	X	X										10–900
19.80	*Leucoraja ocellata* (Mitchill, 1815)	Winter Skate						X													5–725
19.81	*Leucoraja pristispina* Last, Stehmann & Séret, 2008	Sawback Skate													X						200–505
19.82	*Leucoraja wallacei* (Hulley, 1970)	Yellowspotted Skate										X	X								75–515

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19.83	*Leucoraja yucatanensis* (Bigelow & Schroeder, 1950)	Yucatan Skate					X														190–455
19.84	*Malacoraja kreffti* (Stehmann, 1978)	Krefft's Skate							X												1000–1500
19.85	*Malacoraja obscura* Carvalho, Gomes & Gadig, 2005	Brazilian Soft Skate				X															810–1105
19.86	*Malacoraja senta* (Garman, 1885)	Smooth Skate						X													25–1435
19.87	*Malacoraja spinacidermis* (Barnard, 1923)	Prickle Skate						X	X		X	X									450–1570
19.88	*Neoraja africana* (Stehmann & Séret, 1983)	West African Dwarf Skate									X										900–1550
19.89	*Neoraja caerulea* (Stehmann, 1976)	Blue Dwarf Skate							X												600–1260
19.90	*Neoraja carolinensis* McEachran & Stehmann, 1984	Carolina Dwarf Skate						X													695–1010
19.91	*Neoraja iberica* Stehmann *et al.*, 2008	Iberian Dwarf Skate							X												270–670
19.92	*Neoraja stehmanni* (Hulley, 1972)	South African Dwarf Skate										X									290–1025
19.93	*Okamejei acutispina* (Ishiyama, 1958)	Sharpspine Skate																X			30–150
19.94	*Okamejei arafurensis* Last & Gledhill, 2008	Arafura Skate													X		X				180–300
19.95	*Okamejei boesemani* (Ishihara, 1987)	Black Sand Skate															X	X			20–175
19.96	*Okamejei cairae* Last, Fahmi & Ishihara, 2010	Borneo Sand Skate															X				65–150
19.97	*Okamejei heemstrai* (McEachran & Fechhelm, 1982)	Narrow Skate											X								200–500
19.98	*Okamejei hollandi* (Jordan & Richardson, 1909)	Holland Skate															X	X			65–85
19.99	*Okamejei kenojei* (Müller & Henle, 1841)	Spiny Skate																X			20–230
19.100	*Okamejei leptoura* Last & Gledhill, 2008	Australian Thintail Skate													X						200–735
19.101	*Okamejei meerdervoortii* (Bleeker, 1860)	Bigeye Skate																X			50–150
19.102	*Okamejei mengae* Jeong, Nakabo & Wu, 2007	Meng's Skate																X			?
19.103	*Okamejei ornata* Weigmann, Stehmann & Thiel, 2015	Ornate Skate												X							375–390
19.104	*Okamejei schmidti* (Ishiyama, 1958)	Browneye Skate																X			20–60
19.105	*Orbiraja jensenae* (Last & Lim, 2010)	Sulu Ring Skate															X				110–120
19.106	*Orbiraja philipi* (Lloyd, 1906)	Aden Ring Skate												X							~240
19.107	*Orbiraja powelli* (Alcock, 1898)	Indian Ring Skate												X							45–250
19.108	*Raja africana* Capapé, 1977	African Skate								X	X										50–400
19.109	*Raja asterias* Delaroche, 1809	Atlantic Starry Skate							X	X											2–345
19.110	*Raja brachyura* Lafont, 1873	Blonde Skate							X	X	X										1–900
19.111	*Raja clavata* Linnaeus, 1758	Thornback Skate							X	X	X	X	X								10–300
19.112	*Raja herwigi* Krefft, 1965	Cape Verde Skate									X										55–100
19.113	*Raja maderensis* Lowe, 1838	Madeira Skate							X												1–150
19.114	*Raja microocellata* Montagu, 1818	Smalleyed Skate							X		X										1–100

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19.115	*Raja miraletus* Linnaeus, 1758	Brown Skate							X	X											50–800
19.116	*Raja montagui* Fowler, 1910	Spotted Skate							X	X											50–150
19.117	*Raja ocellifera* Regan, 1906	Twineye Skate											X								17–105
19.118	*Raja parva* Last & Séret, 2016	African Brown Skate									X	X									10–300
19.119	*Raja pita* Fricke & Al-Hassan, 1995	Pita Skate												X							~15
19.120	*Raja polystigma* Regan, 1923	Speckle Skate								X											100–400
19.121	*Raja radula* Delaroche, 1809	Rough Skate							X	X											1–350
19.122	*Raja straeleni* Poll, 1951	Biscuit Skate									X	X	X								80–690
19.123	*Raja undulata* Lacepede, 1802	Undulate Skate							X	X	X										1–300
19.124	*Rajella annandalei* (Weber, 1913)	Indonesian Skate															X				400–830
19.125	*Rajella barnardi* (Norman, 1935)	Bigthorn Skate									X	X	X								100–1700
19.126	*Rajella bathyphila* (Holt & Byrne, 1908)	Deepwater Skate						X	X												600–2300
19.127	*Rajella bigelowi* (Stehmann, 1978)	Bigelow's Skate						X	X		X										625–2200
19.128	*Rajella caudaspinosa* (von Bonde & Swart, 1923)	Munchkin Skate										X	X								100–1100
19.129	*Rajella challengeri* Last & Stehmann, 2008	Challenger Skate													X	X					860–1500
19.130	*Rajella dissimilis* (Hulley, 1970)	Ghost Skate							X		X	X									400–1640
19.131	*Rajella eisenhardti* Long & McCosker, 1999	Galapagos Skate		X																	755–905
19.132	*Rajella fuliginea* (Bigelow & Schroeder, 1954)	Sooty Skate					X														730–1280
19.133	*Rajella fyllae* (Lütken, 1887)	Round Skate						X	X										X		150–2055
19.134	*Rajella kukujevi* (Dolganov, 1985)	Mid-Atlantic Skate							X												750–2190
19.135	*Rajella leoparda* (von Bonde & Swart, 1923)	Leopard Skate									X	X	X								130–1920
19.136	*Rajella lintea* (Fries, 1838)	Sail Skate						X	X										X		150–1500
19.137	*Rajella nigerrima* (de Buen, 1960)	Blackish Skate		X	X																590–1000
19.138	*Rajella paucispinosa* Weigmann, Stehmann & Thiel, 2014	Sparsethorn Skate											X								1230–1260
19.139	*Rajella purpuriventralis* (Bigelow & Schroeder, 1962)	Purplebelly Skate					X														730–2010
19.140	*Rajella ravidula* (Hulley, 1970)	Smoothback Skate									X	X									495–1250
19.141	*Rajella sadowskii* (Krefft & Stehmann, 1974)	Brazilian Skate			X	X															800–1360
19.142	*Rostroraja ackleyi* (Garman, 1881)	Ocellate Skate					X														30–385
19.143	*Rostroraja alba* (Lacepede, 1803)	White Skate							X	X	X	X	X								750–2190
19.144	*Rostroraja bahamensis* (Bigelow & Schroeder, 1965)	Bahama Skate					X														390–410
19.145	*Rostroraja cervigoni* (Bigelow & Schroeder, 1964)	Venezuela Skate					X														30–180
19.146	*Rostroraja eglanteria* (Bosc, 1800)	Clearnose Skate					X	X													1–120

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19.147	*Rostroraja equatorialis* (Jordan & Bollman, 1890)	Equatorial Skate		X																	20–200
19.148	*Rostroraja texana* (Chandler, 1921)	Roundel Skate					X														1–185
19.149	*Rostroraja velezi* (Chirichigno, 1973)	Rasptail Skate		X	X																35–140
19.150	*Spiniraja whitleyi* (Iredale, 1938)	Melbourne Skate													X	X					1–345
19.151	*Zearaja argentinensis* (de Astarloa *et al*., 2008)	Argentine Skate				X															85–140
19.152	*Zearaja chilensis* (Guichenot, 1848)	Yellownose Skate			X	X															60–1000
19.153	*Zearaja maugeana* Last & Gledhill, 2007	Maugean Skate													X						<40
19.154	*Zearaja nasuta* (Müller & Henle, 1841)	New Zealand Rough Skate														X					15–660
ARHYNCHOBATIDAE																					
20.1	*Arhynchobatis asperrimus* Waite, 1909	Longtail Skate														X					55–1095
20.2	*Atlantoraja castelnaui* (Miranda Ribeiro, 1907)	Spotback Skate				X															1–220
20.3	*Atlantoraja cyclophora* (Regan, 1903)	Eyespot Skate				X															1–320
20.4	*Atlantoraja platana* (Günther, 1880)	La Plata Skate				X															1–320
20.5	*Bathyraja abyssicola* (Gilbert, 1896)	Deepsea Skate	X															X			395–2905
20.6	*Bathyraja aguja* (Kendall & Radcliffe, 1912)	Aguja Skate		X																	~980
20.7	*Bathyraja albomaculata* (Norman, 1937)	Whitedotted Skate			X	X															70–560
20.8	*Bathyraja aleutica* (Gilbert, 1896)	Aleutian Skate	X															X			250–1600
20.9	*Bathyraja andriashevi* Dolganov, 1983	Little-eye Skate																X			1200–2000
20.10	*Bathyraja bergi* Dolganov, 1983	Bottom Skate																X			70–900
20.11	*Bathyraja brachyurops* (Fowler, 1910)	Broadnose Skate			X	X															30–600
20.12	*Bathyraja cousseauae* Diaz de Astarloa & Mabragana, 2004	Cousseau's Skate			X	X															100–1120
20.13	*Bathyraja diplotaenia* (Ishiyama, 1952)	Duskypink Skate																X			100–1000
20.14	*Bathyraja eatonii* (Günther, 1876)	Eaton's Skate																		X	15–1500
20.15	*Bathyraja fedorovi* Dolganov, 1983	Cinnamon Skate																X			445–2025
20.16	*Bathyraja griseocauda* (Norman, 1937)	Greytail Skate			X	X															80–950
20.17	*Bathyraja hesperafricana* Stehmann, 1995	West African Skate									X										750–2200
20.18	*Bathyraja interrupta* (Gill & Townsend, 1897)	Bering Skate	X															X			0–1370
20.19	*Bathyraja irrasa* Hureau & Ozouf-Costaz, 1980	Kerguelen Skate																		X	300–1220
20.20	*Bathyraja ishiharai* Stehmann, 2005	Abyssal Skate													X	X					2320–2800
20.21	*Bathyraja isotrachys* (Günther, 1877)	Raspback Skate																X			450–1480
20.22	*Bathyraja kincaidii* (Garman, 1908)	Sandpaper Skate	X																		200–1370

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20.23	*Bathyraja leucomelanos* Iglésias & Lévy-Hartmann, 2012	Domino Skate														X					955–1020
20.24	*Bathyraja lindbergi* Ishiyama & Ishihara, 1977	Commander Skate	X															X			125–1195
20.25	*Bathyraja longicauda* (de Buen, 1959)	Slimtail Skate			X																400–735
20.26	*Bathyraja maccaini* Springer, 1971	McCain's Skate																		X	1–500
20.27	*Bathyraja macloviana* (Norman, 1937)	Patagonian Skate			X	X															80–500
20.28	*Bathyraja maculata* Ishiyama & Ishihara, 1977	Whiteblotched Skate	X															X			75–1195
20.29	*Bathyraja magellanica* (Philippi, 1902)	Magellan Skate			X	X															80–600
20.30	*Bathyraja mariposa* Stevenson *et al.*, 2004	Pacific Butterfly Skate																X			90–450
20.31	*Bathyraja matsubarai* (Ishiyama, 1952)	Duskypurple Skate																X			120–2000
20.32	*Bathyraja meridionalis* Stehmann, 1987	Darkbelly Skate			X	X															800–1200
20.33	*Bathyraja microtrachys* (Osburn & Nichols, 1916)	Finespine Skate	X																		1995–3100
20.34	*Bathyraja minispinosa* Ishiyama & Ishihara, 1977	Smallthorn Skate	X															X			150–1420
20.35	*Bathyraja multispinis* (Norman, 1937)	Multispine Skate			X	X															90–740
20.36	*Bathyraja murrayi* (Günther, 1880)	Murray's Skate																		X	30–650
20.37	*Bathyraja notoroensis* Ishiyama & Ishihara, 1977	Notoro Skate																X			~600
20.38	*Bathyraja pacifica* Last, Stewart & Séret, 2016	Pacific Blonde Skate														X					1760–1790
20.39	*Bathyraja pallida* (Forster, 1967)	Pallid Skate							X												1880–2950
20.40	*Bathyraja panthera* Orr *et al.*, 2011	Panther Skate																X			50–260
20.41	*Bathyraja papilionifera* Stehmann, 1985	Atlantic Butterfly Skate				X															660–1615
20.42	*Bathyraja parmifera* (Bean, 1881)	Alaska Skate	X															X			17–400
20.43	*Bathyraja peruana* McEachran & Miyake, 1984	Peruvian Skate		X	X																735–1010
20.44	*Bathyraja richardsoni* (Garrick, 1961)	Richardson's Skate						X	X							X					1220–2990
20.45	*Bathyraja scaphiops* (Norman, 1937)	Cuphead Skate				X															100–500
20.46	*Bathyraja schroederi* (Krefft, 1968)	Whitemouth Skate			X	X															800–2380
20.47	*Bathyraja shuntovi* Dolganov, 1985	Narrownose Skate														X					300–1485
20.48	*Bathyraja simoterus* (Ishiyama, 1967)	Hokkaido Skate																X			95–540
20.49	*Bathyraja smirnovi* (Soldatov & Pavlenko, 1915)	Golden Skate																X			100–1125
20.50	*Bathyraja smithii* (Müller & Henle, 1841)	Softnose Skate										X	X								250–1020
20.51	*Bathyraja spinicauda* (Jensen, 1914)	Spinetail Skate						X	X										X		140–1650
20.52	*Bathyraja spinosissima* (Beebe & Tee-Van, 1941)	Pacific White Skate	X	X														X			800–2940
20.53	*Bathyraja taranetzi* (Dolganov, 1983)	Mud Skate	X															X			80–1000
20.54	*Bathyraja trachouros* (Ishiyama, 1958)	Eremo Skate																X			100–800

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
20.55	*Bathyraja trachura* (Gilbert, 1892)	Roughtail Skate	X	X														X			400–2550
20.56	*Bathyraja tunae* Stehmann, 2005	Cristina's Skate											X								1750–2240
20.57	*Bathyraja tzinovskii* Dolganov, 1983	Creamback Skate																X			1775–2500
20.58	*Bathyraja violacea* (Suvorov, 1935)	Okhotsk Skate	X															X			45–1110
20.59	*Brochiraja aenigma* Last & McEachran, 2006	Enigma Skate														X					420–435
20.60	*Brochiraja albilabiata* Last & McEachran, 2006	Whitelip Skate														X					900–1005
20.61	*Brochiraja asperula* (Garrick & Paul, 1974)	Prickly Deepsea Skate														X					300–1150
20.62	*Brochiraja heuresa* Last & Séret, 2012	Eureka Skate														X					870–1350
20.63	*Brochiraja leviveneta* Last & McEachran, 2006	Smooth Blue Skate														X					300–1200
20.64	*Brochiraja microspinifera* Last & McEachran, 2006	Small Prickly Skate														X					600–1200
20.65	*Brochiraja spinifera* (Garrick & Paul, 1974)	Spiny Deepsea Skate														X					125–1500
20.66	*Brochiraja vittacauda* Last & Séret, 2012	Ribbontail Skate														X					630–975
20.67	*Insentiraja laxipella* Yearsley & Last, 1992	Eastern Looseskin Skate														X					800–880
20.68	*Insentiraja subtilispinosa* (Stehmann, 1989)	Western Looseskin Skate													X		X				320–1460
20.69	*Irolita waitii* (McCulloch, 1911)	Southern Round Skate													X						50–200
20.70	*Irolita westraliensis* Last & Gledhill, 2008	Western Round Skate													X						140–210
20.71	*Notoraja alisae* Séret & Last, 2012	Alis' Velvet Skate														X					870–1050
20.72	*Notoraja azurea* McEachran & Last, 2008	Blue Skate													X	X					765–1440
20.73	*Notoraja fijiensis* Séret & Last, 2012	Fiji Velvet Skate														X					565–700
20.74	*Notoraja hirticauda* Last & McEachran, 2006	Australian Ghost Skate													X						500–760
20.75	*Notoraja inusitata* Séret & Last, 2012	Strange Skate														X					805–845
20.76	*Notoraja lira* McEachran & Last, 2008	Broken Ridge Skate													X						~1050
20.77	*Notoraja longiventralis* Séret & Last, 2012	Longlobe Velvet Skate														X					660–955
20.78	*Notoraja ochroderma* McEachran & Last, 1994	Pale Skate														X					400–455
20.79	*Notoraja sapphira* Séret & Last, 2009	Sapphire Skate														X					1195–1315
20.80	*Notoraja sticta* McEachran & Last, 2008	Blotched Skate													X						820–1200
20.81	*Notoraja tobitukai* (Hiyama, 1940)	Leadhue Skate																X			60–900
20.82	*Pavoraja alleni* McEachran & Fechhelm, 1982	Allen's Skate													X						305–460
20.83	*Pavoraja arenaria* Last, Mallick & Yearsley, 2008	Australian Sandy Skate													X						190–710
20.84	*Pavoraja mosaica* Last, Mallick & Yearsley, 2008	Mosaic Skate														X					300–405
20.85	*Pavoraja nitida* (Günther, 1880)	Peacock Skate													X	X					75–450
20.86	*Pavoraja pseudonitida* Last, Mallick & Yearsley, 2008	False Peacock Skate														X					210–510

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
20.87	*Pavoraja umbrosa* Last, Mallick & Yearsley, 2008	Dusky Skate														X					360–730
20.88	*Psammobatis bergi* Marini, 1932	Blotched Sandskate				X															40–80
20.89	*Psammobatis extenta* (Garman, 1913)	Zipper Sandskate				X															40–160
20.90	*Psammobatis lentiginosa* McEachran, 1983	Freckled Sandskate				X															30–170
20.91	*Psammobatis normani* McEachran, 1983	Shortfin Sandskate			X	X															30–360
20.92	*Psammobatis parvacauda* McEachran, 1983	Smalltail Sandskate				X															120–130
20.93	*Psammobatis rudis* Günther, 1870	Smallthorn Sandskate			X	X															30–475
20.94	*Psammobatis rutrum* Jordan, 1891	Spade Sandskate				X															30–150
20.95	*Psammobatis scobina* (Philippi, 1857)	Raspthorn Sandskate			X																30–450
20.96	*Pseudoraja fischeri* Bigelow & Schroeder, 1954	Fanfin Skate					X														410–575
20.97	*Rhinoraja kujiensis* (Tanaka, 1916)	Dapplebelly Skate																X			450–1000
20.98	*Rhinoraja longicauda* Ishiyama, 1952	Whitebelly Skate																X			300–1000
20.99	*Rhinoraja odai* Ishiyama, 1958	Oda's Skate																X			300–870
20.100	*Rioraja agassizii* (Müller & Henle, 1841)	Rio Skate				X															20–150
20.101	*Sympterygia acuta* Garman, 1877	Bignose Fanskate				X															1–40
20.102	*Sympterygia bonapartii* Müller & Henle, 1841	Smallnose Fanskate				X															1–500
20.103	*Sympterygia brevicaudata* (Cope, 1877)	Shorttail Fanskate		X	X																1–80
20.104	*Sympterygia lima* (Poeppig, 1835)	Filetail Fanskate			X																1–80
GURGESIELLIDAE																					
21.1	*Cruriraja andamanica* (Lloyd, 1909)	Andaman Pygmy Skate											X	X							275–510
21.2	*Cruriraja atlantis* Bigelow & Schroeder, 1948	Atlantic Pygmy Skate					X														510–860
21.3	*Cruriraja cadenati* Bigelow & Schroeder, 1962	Broadfoot Pygmy Skate					X														455–895
21.4	*Cruriraja durbanensis* (von Bonde & Swart, 1923)	Smoothnose Pygmy Skate										X									~860
21.5	*Cruriraja hulleyi* Aschliman, Ebert & Compagno, 2010	Hulley's Pygmy Skate										X	X								40–545
21.6	*Cruriraja parcomaculata* (von Bonde & Swart, 1923)	Roughnose Pygmy Skate											X								65–680
21.7	*Cruriraja poeyi* Bigelow & Schroeder, 1948	Poey's Pygmy Skate					X														365–870
21.8	*Cruriraja rugosa* Bigelow & Schroeder, 1958	Rough Pygmy Skate				X	X														250–1010
21.9	*Fenestraja atripinna* (Bigelow & Schroeder, 1950)	Blackfin Pygmy Skate					X	X													365–950
21.10	*Fenestraja cubensis* (Bigelow & Schroeder, 1950)	Cuban Pygmy Skate					X														310–870
21.11	*Fenestraja ishiyamai* (Bigelow & Schroeder, 1962)	Plain Pygmy Skate					X														505–950
21.12	*Fenestraja maceachrani* (Séret, 1989)	Madagascar Pygmy Skate											X								600–765
21.13	*Fenestraja mamillidens* (Alcock, 1889)	Prickly Pygmy Skate												X							~1095

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21.14	*Fenestraja plutonia* (Garman, 1881)	Pluto Pygmy Skate					X	X													295–1025
21.15	*Fenestraja sibogae* (Weber, 1913)	Siboga Pygmy Skate													X						~290
21.16	*Fenestraja sinusmexicanus* (Bigelow & Schroeder, 1950)	Gulf Pygmy Skate					X														60–1095
21.17	*Gurgesiella atlantica* (Bigelow & Schroeder, 1962)	Atlantic Finless Skate					X														245–960
21.18	*Gurgesiella dorsalifera* McEachran & Compagno, 1980	Onefin Skate				X															400–800
21.19	*Gurgesiella furvescens* de Buen, 1959	Dusky Finless Skate			X																300–960
ANACANTHOBATIDAE																					
22.1	*Anacanthobatis marmorata* (von Bonde & Swart, 1923)	Spotted Legskate											X								200–435
22.2	*Indobatis ori* (Wallace, 1967)	Black Legskate											X								1000–1725
22.3	*Schroederobatus americana* (Bigelow & Schroeder, 1962)	American Legskate					X														185–915
22.4	*Sinobatis bengalensis* Last & Bussarawit, 2016	Bengal Legskate												X							?
22.5	*Sinobatis borneensis* (Chan, 1965)	Borneo Legskate															X	X			475–835
22.6	*Sinobatis brevicauda* Weigmann & Stehmann, 2016	Shorttail Legskate											X								960–1130
22.7	*Sinobatis bulbicauda* Last & Séret, 2008	West Australian Legskate													X		X				150–1125
22.8	*Sinobatis caerulea* Last & Séret, 2008	Indigo Legskate													X						480–1170
22.9	*Sinobatis filicauda* Last & Séret, 2008	East Australian Legskate														X					605–880
22.10	*Sinobatis melanosoma* (Chan, 1965)	Blackbody Legskate															X	X			575–1100
22.11	*Sinobatis stenosoma* (Li & Hu, 1982)	Narrow Legskate																X			~535
22.12	*Springeria folirostris* Bigelow & Schroeder, 1951	Leafnose Legskate					X														300–510
22.13	*Springeria longirostris* (Bigelow & Schroeder, 1962)	Longnose Legskate					X														500–1050
HEXATRYGONIDAE																					
23.1	*Hexatrygon bickelli* Heemstra & Smith, 1980	Sixgill Stingray		X								X	X	X	X	X	X	X			360–1120
GYMNURIDAE																					
24.1	*Gymnura altavela* (Linnaeus, 1758)	Spiny Butterfly Ray				X	X	X	X	X	X										1–150
24.2	*Gymnura australis* (Ramsay & Ogilby, 1886)	Australian Butterfly Ray													X	X	X				1–250
24.3	*Gymnura crebripunctata* (Peters, 1869)	Mazatlán Butterfly Ray		X	X																1–30
24.4	*Gymnura japonica* (Temminck & Schlegel, 1850)	Japanese Butterfly Ray																X			<40
24.5	*Gymnura marmorata* (Cooper, 1864)	Californian Butterfly Ray		X																	1–95
24.6	*Gymnura micrura* (Bloch & Schneider, 1801)	Smooth Butterfly Ray				X	X	X			X										1–40
24.7	*Gymnura natalensis* (Gilchrist & Thompson, 1911)	Backwater Butterfly Ray										X	X								1–75
24.8	*Gymnura poecilura* (Shaw, 1804)	Longtail Butterfly Ray												X	X		X	X			1–30
24.9	*Gymnura tentaculata* (Müller & Henle, 1841)	Tentacle Butterfly Ray												X							1–75

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24.10	*Gymnura zonura* (Bleeker, 1852)	Zonetail Butterfly Ray												X	X		X	X			1–35
DASYATIDAE																					
25.1	*Bathytoshia brevicaudata* (Hutton, 1875)	Smooth Stingray											X		X	X		X			0–480
25.2	*Bathytoshia centroura* (Mitchill, 1815)	Roughtail Stingray				X	X	X													1–275
25.3	*Bathytoshia lata* (Garman, 1880)	Brown Stingray		X					X	X	X		X	X	X	X	X	X			1–800
25.4	*Brevitrygon heterura* (Bleeker, 1852)	Dwarf Whipray												X			X				1–50
25.5	*Brevitrygon imbricata* (Bloch & Schneider, 1801)	Bengal Whipray												X							<100
25.6	*Brevitrygon javaensis* (Last & White, 2013)	Javan Whipray													X						<100
25.7	*Brevitrygon walga* (Müller & Henle, 1841)	Scaly Whipray												X							<100
25.8	*Dasyatis chrysonota* (Smith, 1828)	Blue Stingray										X	X								1–110
25.9	*Dasyatis hypostigma* Santos & Carvalho, 2004	Groovebelly Stingray				X															5–80
25.10	*Dasyatis marmorata* (Steindachner, 1892)	Marbled Stingray									X										1–40
25.11	*Dasyatis pastinaca* (Linnaeus, 1758)	Common Stingray							X	X	X										1–140
25.12	*Dasyatis tortonesei* Capapé, 1977	Tortonese's Stingray							X	X	X										1–100
25.13	*Fluvitrygon kittipongi* (Vidthayanon & Roberts, 2006)	Roughback Whipray															X				<40
25.14	*Fluvitrygon oxyrhynchus* (Sauvage, 1878)	Marbled Whipray															X				<40
25.15	*Fluvitrygon signifer* (Compagno & Roberts, 1982)	White-edge Whipray															X				<40
25.16	*Fontitrygon colarensis* (Santos, Gomes & Charvet-Almeida, 2004)	Colares Stingray				X															<40
25.17	*Fontitrygon garouaensis* (Stauch & Blanc, 1962)	Smooth Whipray									X										<40
25.18	*Fontitrygon geijskesi* (Boeseman, 1948)	Wingfin Stingray				X	X														1–80
25.19	*Fontitrygon margarita* (Günther, 1870)	Daisy Whipray									X										1–60
25.20	*Fontitrygon margaritella* (Compagno & Roberts, 1984)	Pearl Whipray									X										1–60
25.21	*Fontitrygon ukpam* (Smith, 1863)	Thorny Whipray									X										<40
25.22	*Hemitrygon akajei* (Müller & Henle, 1841)	Red Stingray																X			1–50
25.23	*Hemitrygon bennetti* (Müller & Henle, 1841)	Bennett's Stingray															X	X			<100
25.24	*Hemitrygon fluviorum* (Ogilby, 1908)	Estuary Stingray														X	X				<40
25.25	*Hemitrygon izuensis* (Nishida & Nakaya, 1988)	Izu Stingray																X			10–20
25.26	*Hemitrygon laevigata* (Chu, 1960)	Yantai Stingray																X			1–60
25.27	*Hemitrygon laosensis* (Roberts & Karnasuta, 1987)	Mekong Stingray															X				<40
25.28	*Hemitrygon longicauda* (Last & White, 2013)	Merauke Stingray														X	X				<40
25.29	*Hemitrygon navarrae* (Steindachner, 1892)	Oriental Black Stingray															X	X			<100

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25.30	*Hemitrygon parvonigra* (Last & White, 2008)	Dwarf Black Stingray													X		X				60–185
25.31	*Hemitrygon sinensis* (Steindachner, 1892)	Chinese Stingray																X			<100
25.32	*Himantura australis* Last, White & Naylor, 2016	Australian Whipray													X	X	X				1–45
25.33	*Himantura leoparda* Manjaji-Matsumoto & Last, 2008	Leopard Whipray											X	X	X	X	X	X			1–70
25.34	*Himantura uarnak* (Gmelin, 1789)	Coach Whipray											X	X	X		X				1–50
25.35	*Himantura undulata* (Bleeker, 1852)	Honeycomb Whipray												X	X		X				<100
25.36	*Hypanus americanus* (Hildebrand & Schroeder, 1928)	Southern Stingray				X	X	X													1–55
25.37	*Hypanus dipterurus* (Jordan & Gilbert, 1880)	Diamond Stingray		X																	0–150
25.38	*Hypanus guttatus* (Bloch & Schneider, 1801)	Longnose Stingray				X	X														1–35
25.39	*Hypanus longus* (Garman, 1880)	Longtail Stingray		X																	1–90
25.40	*Hypanus marianae* (Gomes, Rosa & Gadig, 2000)	Large-eye Stingray				X															<40
25.41	*Hypanus rudis* (Günther, 1870)	Smalltooth Stingray									X										1–30
25.42	*Hypanus sabinus* (Lesueur, 1824)	Atlantic Stingray					X	X													1–25
25.43	*Hypanus say* (Lesueur, 1817)	Bluntnose Stingray				X	X	X													<40
25.44	*Maculabatis ambigua* Last, Bogorodsky & Alpermann, 2016	Baraka's Whipray												X							<100
25.45	*Maculabatis arabica* Manjaji-Matsumoto & Last, 2016	Pakistan Whipray												X							<100
25.46	*Maculabatis astra* (Last, Manjaji-Matsumoto & Pogonoski, 2008)	Blackspotted Whipray													X	X	X				1–140
25.47	*Maculabatis bineeshi* Manjaji-Matsumoto & Last, 2016	Shorttail Whipray												X							<100
25.48	*Maculabatis gerrardi* (Gray, 1851)	Whitespotted Whipray												X	X		X	X			1–60
25.49	*Maculabatis macrura* (Bleeker, 1852)	Sharpnose Whipray													X		X	X			1–60
25.50	*Maculabatis pastinacoides* (Bleeker, 1852)	Round Whipray															X				<100
25.51	*Maculabatis randalli* (Last, Manjaji-Matsumoto & Moore, 2012)	Arabian Banded Whipray												X							1–60
25.52	*Maculabatis toshi* (Whitley, 1939)	Brown Whipray														X	X				<40
25.53	*Makararaja chindwinensis* Roberts, 2007	Chindwin Cowtail Ray												X							<40
25.54	*Megatrygon microps* (Annandale, 1908)	Smalleye Stingray											X	X	X	X	X				<200
25.55	*Neotrygon annotata* (Last, 1987)	Plain Maskray													X	X	X				10–60
25.56	*Neotrygon australiae* Last, White & Séret, 2016	Australian Bluespotted Maskray													X	X	X				1–90
25.57	*Neotrygon caeruleopunctata* Last, White & Séret, 2016	Bluespotted Maskray											X	X	X						<100
25.58	*Neotrygon kuhlii* (Müller & Henle, 1841)	Kuhl's Maskray														X					<100

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
25.59	*Neotrygon leylandi* (Last, 1987)	Painted Maskray													X						15–90
25.60	*Neotrygon ningalooensis* Last, White & Puckridge, 2010	Ningaloo Maskray													X		X				1–5
25.61	*Neotrygon orientalis* Last, White & Séret, 2016	Oriental Bluespotted Maskray															X	X			<100
25.62	*Neotrygon picta* Last & White, 2008	Speckled Maskray														X	X				1–100
25.63	*Neotrygon trigonoides* (Castelnau, 1873)	Coral Sea Maskray														X					5–50
25.64	*Neotrygon varidens* (Garman, 1885)	Mahogany Maskray															X	X			<100
25.65	*Pastinachus ater* (Macleay, 1883)	Broad Cowtail Ray											X	X	X	X	X				<100
25.66	*Pastinachus gracilicaudus* Last & Manjaji-Matsumoto, 2010	Narrow Cowtail Ray												X			X				<100
25.67	*Pastinachus sephen* (Forsskål, 1775)	Cowtail Ray												X							<100
25.68	*Pastinachus solocirostris* Last, Manjaji & Yearsley, 2005	Roughnose Cowtail Ray															X				<40
25.69	*Pastinachus stellurostris* Last, Fahmi & Naylor, 2010	Starrynose Cowtail Ray															X				<40
25.70	*Pateobatis bleekeri* (Blyth, 1860)	Bleeker's Whipray												X							1–40
25.71	*Pateobatis fai* (Jordan & Seale, 1906)	Pink Whipray		X									X	X	X	X	X	X			1–70
25.72	*Pateobatis hortlei* (Last, Manjaji-Matsumoto & Kailola, 2006)	Hortle's Whipray														X	X				<40
25.73	*Pateobatis jenkinsii* (Annandale, 1909)	Jenkins' Whipray											X	X	X	X	X				1–90
25.74	*Pateobatis uarnacoides* (Bleeker, 1852)	Whitenose Whipray												X			X				1–30
25.75	*Pteroplatytrygon violacea* (Bonaparte, 1832)	Pelagic Stingray	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			<200
25.76	*Taeniura lessoni* Last, White & Naylor, 2016	Oceania Fantail Ray														X	X				<20
25.77	*Taeniura lymma* (Forsskål, 1775)	Bluespotted Fantail Ray											X	X	X	X	X				0–20
25.78	*Taeniurops grabatus* (Geoffroy Saint-Hilaire, 1817)	Round Stingray							X	X	X			X							1–100
25.79	*Taeniurops meyeni* (Müller & Henle, 1841)	Blotched Fantail Ray											X	X	X	X	X	X			1–400
25.80	*Telatrygon acutirostra* (Nishida & Nakaya, 1988)	Sharpnose Ray																X			55–140
25.81	*Telatrygon biasa* Last, White & Naylor, 2016	Indonesian Sharpnose Ray												X	X		X				1–40
25.82	*Telatrygon crozieri* (Blyth, 1860)	Indian Sharpnose Ray												X							<100
25.83	*Telatrygon zugei* (Müller & Henle, 1841)	Pale-edge Sharpnose Ray															X	X			1–100
25.84	*Urogymnus acanthobothrium* Last, White & Kyne, 2016	Langinyngan Whipray														X	X				1–60
25.85	*Urogymnus asperrimus* (Bloch & Schneider, 1801)	Porcupine Whipray									X		X	X	X	X	X	X			<40
25.86	*Urogymnus dalyensis* (Last & Manjaji-Matsumoto, 2008)	Freshwater Whipray													X	X	X				<40
25.87	*Urogymnus granulatus* (Macleay, 1883)	Mangrove Whipray												X	X	X	X				0–85
25.88	*Urogymnus lobistoma* (Manjaji-Matsumoto & Last, 2006)	Tubemouth Whipray															X				<40

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25.89	*Urogymnus polylepis* (Bleeker, 1852)	Giant Freshwater Whipray												X			X				<40
POTAMOTRYGONIDAE																					
26.1	*Heliotrygon gomesi* Carvalho & Lovejoy, 2011	Gomes's Round Ray				X															<40
26.2	*Heliotrygon rosai* Carvalho & Lovejoy, 2011	Rosa's Round Ray				X															<40
26.3	*Paratrygon aiereba* (Müller & Henle, 1841)	Discus Stingray				X	X														<40
26.4	*Plesiotrygon iwamae* Rosa, Castello, & Thorson, 1987	Antenna Ray				X															<40
26.5	*Plesiotrygon nana* Carvalho & Ragno, 2011	Dwarf Antenna Ray				X															<40
26.6	*Potamotrygon albimaculata* Carvalho, 2016	Tapajos Freshwater Stingray				X															<40
26.7	*Potamotrygon amandae* Loboda & Carvalho, 2013	Amanda's Freshwater Stingray				X															<40
26.8	*Potamotrygon boesemani* Rosa, Carvalho & Wanderley, 2008	Surinam Freshwater Stingray				X															<40
26.9	*Potamotrygon brachyura* (Günther, 1880)	Giant Freshwater Stingray				X															<40
26.10	*Potamotrygon constellata* (Vaillant, 1880)	Rough Freshwater Stingray				X															<40
26.11	*Potamotrygon falkneri* Castex & Maciel, 1963	Paraná Freshwater Stingray				X															<40
26.12	*Potamotrygon henlei* (Castelnau, 1855)	Henle's Freshwater Stingray				X															<40
26.13	*Potamotrygon histrix* (Müller & Henle, 1836)	Porcupine Freshwater Stingray				X															<40
26.14	*Potamotrygon humerosa* Garman, 1913	False Freshwater Stingray				X															<40
26.15	*Potamotrygon jabuti* Carvalho, 2016	Pearl Freshwater Stingray				X															<40
26.16	*Potamotrygon leopoldi* Castex & Castello, 1970	Xingu Freshwater Stingray				X															<40
26.17	*Potamotrygon limai* Fontenelle, Silva & Carvalho, 2014	Madeira Freshwater Stingray				X															<40
26.18	*Potamotrygon magdalenae* (Valenciennes, 1865)	Magdalena Freshwater Stingray					X														<40
26.19	*Potamotrygon marinae* Deynat, 2006	Frecnh Guiana Freshwater Stingray				X															<40
26.20	*Potamotrygon motoro* (Müller & Henle, 1841)	Ocellate Freshwater Stingray				X	X														<40
26.21	*Potamotrygon ocellata* (Engelhardt, 1912)	Marajó Freshwater Stingray				X															<40
26.22	*Potamotrygon orbignyi* (Castelnau, 1855)	Reticulate Freshwater Stingray				X	X														<40

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
26.23	*Potamotrygon pantanensis* Loboda & Carvalho, 2013	Patanal Freshwater Stingray				X															<40
26.24	*Potamotrygon rex* Carvalho, 2016	Rondon's Freshwater Stingray				X															<40
26.25	*Potamotrygon schroederi* Fernandez-Yépez, 1958	Schroeder's Freshwater Stingray				X	X														<40
26.26	*Potamotrygon schuhmacheri* Castex, 1964	Rosette Freshwater Stingray				X															<40
26.27	*Potamotrygon scobina* Garman, 1913	Whitespotted Freshwater Stingray				X															<40
26.28	*Potamotrygon signata* Garman, 1913	Parnaiba Freshwater Stingray				X															<40
26.29	*Potamotrygon tatianae* Silva & Carvalho, 2011	Tatiana's Freshwater Stingray				X															<40
26.30	*Potamotrygon tigrina* Carvalho, Sabaj-Perez & Lovejoy, 2011	Tiger Freshwater Stingray				X															<40
26.31	*Potamotrygon wallacei* Carvalho, Rosa & Araujo, 2016	Wallace's Freshwater Stingray				X															<40
26.32	*Potamotrygon yepezi* Castex & Castello, 1970	Maracaibo Freshwater Stingray					X														<40
26.33	*Styracura pacifica* (Beebe & Tee-Van, 1941)	Pacific Chupare		X																	<40
26.34	*Styracura schmardae* (Werner, 1904)	Atlantic Chupare					X														<40
UROTRYGONIDAE																					
27.1	*Urobatis concentricus* Osburn & Nichols, 1916	Bullseye Round Ray		X																	1–30
27.2	*Urobatis halleri* (Cooper, 1863)	Haller's Round Ray	X	X																	1–90
27.3	*Urobatis jamaicensis* (Cuvier, 1816)	Yellow Round Ray					X	X													<40
27.4	*Urobatis maculatus* Garman, 1913	Spotted Round Ray		X																	1–30
27.5	*Urobatis pardalis* Moral-Flores *et al.*, 2015	Leopard Round Ray		X																	1–55
27.6	*Urobatis tumbesensis* (Chirichigno & McEachran, 1979)	Tumbes Round Ray		X																	1–20
27.7	*Urotrygon aspidura* (Jordan & Gilbert, 1882)	Spinytail Round Ray		X																	5–25
27.8	*Urotrygon chilensis* (Günther, 1872)	Chilean Round Ray		X	X																<40
27.9	*Urotrygon cimar* López & Bussing, 1998	Cimar Round Ray		X																	1–85
27.10	*Urotrygon microphthalmum* Delsman, 1941	Smalleye Round Ray				X	X														15–55
27.11	*Urotrygon munda* Gill, 1863	Munda Round Ray		X	X																5–50
27.12	*Urotrygon nana* Miyake & McEachran, 1988	Dwarf Round Ray		X																	2–15

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
27.13	*Urotrygon reticulata* Miyake & McEachran, 1988	Reticulate Round Ray		X																	1–15
27.14	*Urotrygon rogersi* (Jordan & Starks, 1895)	Roger's Round Ray		X																	1–30
27.15	*Urotrygon simulatrix* Miyake & McEachran, 1988	Fake Round Ray		X																	<40
27.16	*Urotrygon venezuelae* Schultz, 1949	Venezuelan Round Ray					X														<40
PLESIOBATIDAE																					
28.1	*Plesiobatis daviesi* (Wallace, 1967)	Giant Stingaree		X									X	X	X	X	X	X			275–680
UROLOPHIDAE																					
29.1	*Spinilophus armatus* (Müller & Henle, 1841)	New Ireland Stingaree															X				?
29.2	*Trygonoptera galba* Last & Yearsley, 2008	Yellow Shovelnose Stingaree													X						100–210
29.3	*Trygonoptera imitata* Yearsley, Last & Gomon, 2008	Eastern Shovelnose Stingaree													X	X					1–120
29.4	*Trygonoptera mucosa* (Whitley, 1939)	Western Shovelnose Stingaree													X						1–40
29.5	*Trygonoptera ovalis* Last & Gomon, 1987	Striped Stingaree													X						1–45
29.6	*Trygonoptera personata* Last & Gomon, 1987	Masked Stingaree													X						1–115
29.7	*Trygonoptera testacea* Müller & Henle, 1841	Common Stingaree														X					1–135
29.8	*Urolophus aurantiacus* Müller & Henle, 1841	Oriental Stingaree															X	X			1–205
29.9	*Urolophus bucculentus* Macleay, 1884	Sandyback Stingaree													X	X					65–265
29.10	*Urolophus circularis* McKay, 1966	Circular Stingaree													X						1–120
29.11	*Urolophus cruciatus* (Lacépède, 1804)	Banded Stingaree													X	X					1–210
29.12	*Urolophus deforgesi* Séret & Last, 2003	Chesterfield Stingaree														X					205–330
29.13	*Urolophus expansus* McCulloch, 1916	Wide Stingaree													X						130–420
29.14	*Urolophus flavomosaicus* Last & Gomon, 1987	Patchwork Stingaree													X	X					60–320
29.15	*Urolophus gigas* Scott, 1954	Spotted Stingaree													X	X					1–50
29.16	*Urolophus javanicus* (Martens, 1864)	Java Stingaree															X				<100
29.17	*Urolophus kaianus* Günther, 1880	Kai Stingaree															X				~230
29.18	*Urolophus kapalensis* Yearsley & Last, 2006	Kapala Stingaree														X					10–130
29.19	*Urolophus lobatus* McKay, 1966	Lobed Stingaree													X						1–30
29.20	*Urolophus mitosis* Last & Gomon, 1987	Mitotic Stingaree													X						100–200
29.21	*Urolophus neocaledoniensis* Séret & Last, 2003	New Caledonian Stingaree														X					230–430
29.22	*Urolophus orarius* Last & Gomon, 1987	Coastal Stingaree													X						5–50
29.23	*Urolophus papilio* Séret & Last, 2003	Butterfly Stingaree														X					~330

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
29.24	*Urolophus paucimaculatus* Dixon, 1969	Sparsely-spotted Stingaree													X	X					1–150
29.25	*Urolophus piperatus* Séret & Last, 2003	Coral Sea Stingaree														X					170–370
29.26	*Urolophus sufflavus* Whitley, 1929	Yellowback Stingaree														X					100–160
29.27	*Urolophus viridis* McCulloch, 1916	Greenback Stingaree													X	X					20–300
29.28	*Urolophus westraliensis* Last & Gomon, 1987	Brown Stingaree													X						60–220
MYLIOBATIDAE																					
30.1	*Aetomylaeus asperrimus* (Gilbert, 1898)	Roughskin Eagle Ray		X																	<40
30.2	*Aetomylaeus bovinus* (Geoffroy St.Hilaire, 1817)	Duckbill Eagle Ray							X	X	X	X	X								1–150
30.3	*Aetomylaeus caeruleofasciatus* White, Last & Baje, 2015	Bluebanded Eagle Ray													X	X	X				10–115
30.4	*Aetomylaeus maculatus* (Gray, 1834)	Mottled Eagle Ray												X			X	X			1–60
30.5	*Aetomylaeus milvus* (Müller & Henle, 1841)	Ocellate Eagle Ray												X							<100
30.6	*Aetomylaeus nichofii* (Bloch & Schneider, 1801)	Banded Eagle Ray												X	X		X	X			1–100
30.7	*Aetomylaeus vespertilio* (Bleeker, 1852)	Ornate Eagle Ray											X	X	X	X	X	X			1–110
30.8	*Myliobatis aquila* (Linnaeus, 1758)	Common Eagle Ray							X	X	X	X	X								1–100
30.9	*Myliobatis californicus* Gill, 1865	Bat Eagle Ray	X	X																	1–50
30.10	*Myliobatis chilensis* Philippi, 1892	Chilean Eagle Ray			X																1–100
30.11	*Myliobatis freminvillei* Lesueur, 1824	Bullnose Eagle Ray				X	X	X													<40
30.12	*Myliobatis goodei* Garman, 1885	Southern Eagle Ray				X	X	X													1–180
30.13	*Myliobatis hamlyni* Ogilby, 1911	Purple Eagle Ray													X	X	X	X			120–350
30.14	*Myliobatis longirostris* Applegate & Fitch, 1964	Longnose Eagle Ray		X																	1–65
30.15	*Myliobatis peruvianus* Garman, 1913	Peruvian Eagle Ray			X																<100
30.16	*Myliobatis ridens* Ruocco *et al.*, 2012	Shortnose Eagle Ray				X															5–45
30.17	*Myliobatis tenuicaudatus* Hector, 1877	New Zealand Eagle Ray													X	X					0–420
30.18	*Myliobatis tobijei* Bleeker, 1854	Japanese Eagle Ray																X			<40
AETOBATIDAE																					
31.1	*Aetobatus flagellum* (Bloch & Schneider, 1801)	Longhead Eagle Ray												X			X				<40
31.2	*Aetobatus laticeps* Gill, 1865	Pacific Eagle Ray		X																	<100
31.3	*Aetobatus narinari* (Euphrasen, 1790)	Whitespotted Eagle Ray				X	X	X			X										0–60
31.4	*Aetobatus narutobiei* White, Furumitsu & Yamaguchi, 2013	Naru Eagle Ray															X	X			0–60
31.5	*Aetobatus ocellatus* (Kuhl, 1823)	Spotted Eagle Ray		X									X	X	X	X	X	X			<100

Order	Scientific name	Common name	ENP	ECP	ESP	WSA	WCA	WNA	ENA	MED	ECA	ESA	WIO	NIO	EIO	WSP	WCP	WNP	ARC	SOC	Depth (m)
RHINOPTERIDAE																					
32.1	*Rhinoptera bonasus* (Mitchill, 1815)	American Cownose Ray				X	X	X													<100
32.2	*Rhinoptera brasiliensis* Müller, 1836	Ticon Cownose Ray				X	X														0–20
32.3	*Rhinoptera javanica* Müller & Henle, 1841	Javan Cownose Ray												X	X		X	X			<40
32.4	*Rhinoptera jayakari* Boulenger, 1895	Shorttail Cownose Ray											X	X	X		X	X			<100
32.5	*Rhinoptera marginata* (Geoffroy St. Hilaire, 1817)	Lusitanian Cownose Ray							X	X	X										<100
32.6	*Rhinoptera neglecta* Ogilby, 1912	Australian Cownose Ray													X	X	X				<40
32.7	*Rhinoptera peli* Bleeker, 1863	African Cownose Ray									X										<40
32.8	*Rhinoptera steindachneri* Evermann & Jenkins, 1891	Hawkray Cownose Ray		X																	0–65
MOBULIDAE																					
33.1	*Mobula alfredi* (Krefft, 1868)	Reef Manta Ray		X							X		X	X	X	X	X	X			<100
33.2	*Mobula birostris* (Walbaum 1792)	Giant Manta Ray	X	X	X	X	X	X	X		X		X	X	X	X	X	X			<100
33.3	*Mobula hypostoma* (Bancroft, 1831)	Atlantic Devilray				X	X	X			X										<40
33.4	*Mobula kuhlii* (Müller & Henle, 1841)	Kuhl's Devilray											X	X	X	X	X				0–50
33.5	*Mobula mobular* (Bonnaterre, 1788)	Giant Devilray	X	X		X				X	X			X	X	X	X	X			<100
33.6	*Mobula munkiana* Notarbartolo-di-Sciara, 1987	Pygmy Devilray		X																	<40
33.7	*Mobula tarapacana* (Philippi, 1892)	Chilean Devilray		X			X				X	X	X	X	X	X	X	X			<100
33.8	*Mobula thurstoni* (Lloyd, 1908)	Bentfin Devilray		X	X	X					X		X	X	X	X	X	X			<100

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Nature

Rays are among the largest fishes and evolved from sharklike ancestors nearly 200 million years ago. They share with sharks many life history traits: all species are carnivores or scavengers; all reproduce by internal fertilization; and all have similar morphological and anatomical characteristics, such as skeletons built of cartilage. *Rays of the World* is the first complete pictorial atlas of the world's ray fauna and includes information on many species only recently discovered by scientists while undertaking research for the book. It includes all 26 families and 633 valid named species of rays, but additional undescribed species exist for many groups.

Rays of the World features a unique collection of paintings of all living species by Australian natural history artist Lindsay Marshall, compiled as part of a multinational research initiative, the Chondrichthyan Tree of Life Project. Images sourced from around the planet were used by the artist to illustrate the fauna. This comprehensive overview of the world's ray fauna summarizes information such as general identifying features and distributional information about these iconic, but surprisingly poorly known, fishes. It will enable readers to gain a better understanding of the rich diversity of rays and promote wider public interest in the group.

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